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0068

COUNTRY USSR

REPORT

SUBJECT Soviet Technical Manual Entitled Amphibious Tracked Carrier Model K-61

DATE DISTR. 25 June 1963 50X1-HUM

NO. PAGES 1

REFERENCES RD

DATE OF INFO. 50X1-HUM

PLACE & DATE ACQ. 50X1-HUM

THIS IS UNEVALUATED INFORMATION. SOURCE GRADINGS ARE DEFINITIVE. APPRAISAL OF CONTENT IS TENTATIVE.

Soviet English-language manual entitled Amphibious Tracked Carrier Model K-61, Brief Technical Manual, consisting of 92 pages 50X1-HUM No publishing data are given. The main chapter headings are as follows: General Information and Brief Description; Fuel, Oil and Coolant Servicing; Operating Carrier; Probable Troubles and Remedies; Summer and Winter Operation of Carrier; Purpose and Operation of Filling Unit. 50X1-HUM

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AMPHIBIOUS TRACKED CARRIER K-61

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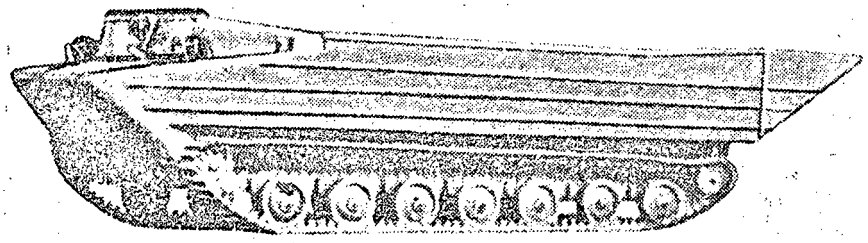
AMPHIBIOUS TRACKED CARRIER

MODEL K-61

BRIEF TECHNICAL MANUAL



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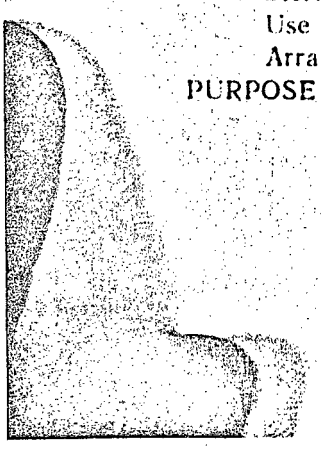

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GENERAL INFORMATION AND BRIEF DESCRIPTION

The Model K-61 carrier is a tracked vehicle possessing floatability in virtue of its water-tight hull.

The carrier is propelled in the water by two screws installed in the stern tunnels.

The carrier crew consists of two men: the commander and the driver.

The carrier equipment includes a kit of spare parts, tools and accessories necessary for the maintenance and operation of the vehicle.

The general design of the carrier is as follows:

The steel welded hull is divided into three sections: the driver's compartment, the engine compartment and the cargo compartment. The engine compartment accommodates a ЯАЗ-М20ВКр power unit which is an assembly of a 130 *h.p.* two-stroke, airless-injection diesel engine, a single-disc engine clutch and a five-speed synchromesh gearbox (Fig. 1).

The torque developed by the engine is transmitted by the gearbox through a needle bearing type propeller shaft to a transfer case, which is a reduction gear incorporating three sliding gears and one sliding dog clutch.

The transfer case distributes the torque between the track and the water movers. The torque is transmitted to the track drive sprockets and the tracks from the transfer case trough an axle drive (which is a bevel-type reduction gear), multiplate steering clutches and final drives, all these units being coupled by means of propeller shafts to eliminate the necessity of accurate alignment.

Torque transmission to the two screws installed in the stern tunnels is effected by means of propeller and screw shafts protected with special casings.

The track assembly and suspension of the carrier consist of 14 rubber-tyred road wheels, 14 torsion bars, two idler wheels, two support slides, two track drive sprockets and two tracks.

The engine and other mechanisms as well as the operation of the carrier are controlled by the driver from his compartment through the use of appropriate control levers, handles and pedals.

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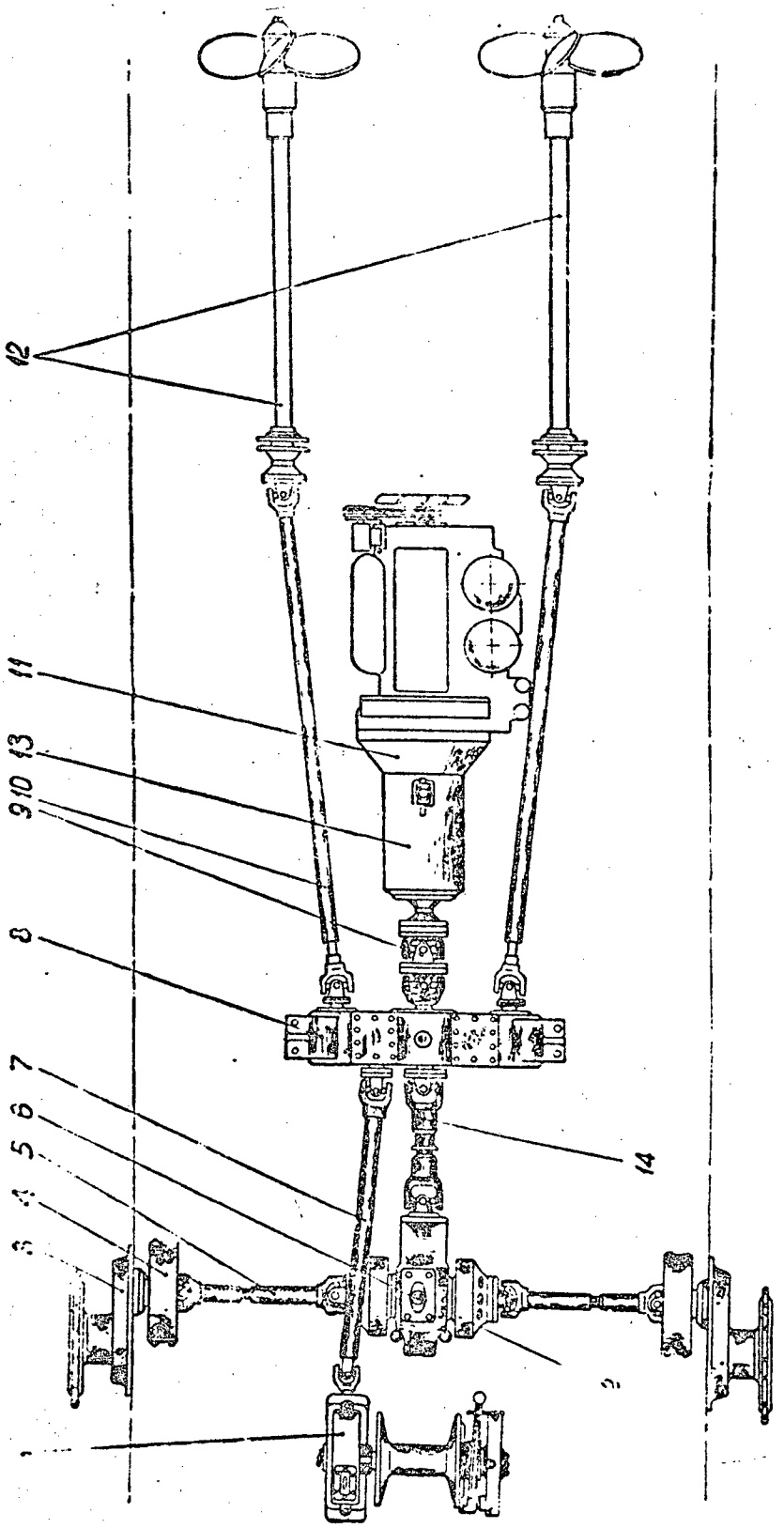

Fig. 1. Power transmission layout:
1—winch; *2*—steering clutch; *3*—final drive; *4*—brake drum; *5*—steering clutch to final drive propeller shaft; *6*—axle drive; *7*—transfer case to winch propeller shaft; *8*—transfer case; *9*—gearbox to transfer case propeller shaft; *10*—transfer case to screw shaft propeller shaft; *11*—engine clutch; *12*—screw shafts; *13*—gearbox; *14*—transfer case to axle drive propeller shaft

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Braking and tight turns are accomplished by means of brake bands fitted with cast iron brake shoes.

To provide for good manoeuvrability in water, the carrier can be steered by individually reversing the screws in addition to the use of rudders mounted aft of the screws.

To load and fasten the cargo the carrier has a power-driven winch, a platform arranged for carrying trucks and special systems, a drop gate with swivel ramps and fixtures for securing trucks, special systems and other loads.

Power to drive the winch is taken from the transfer case.

To drain the hull of water that may penetrate through upset track assembly and hatch seals or through leaks caused by damage to the hull bottom or skin, the carrier is provided with two drainage pumps driven from the transfer case.

The drainage pumps are brought into operation automatically to run during the work of the propulsion screws and have a total capacity of 800 *lit* per *min*.

The engine cooling system incorporates a heat exchanger (Fig. 2) which is mounted between the radiator and the engine. When the carrier is afloat, the heat exchanger makes use of the outboard water to reduce the temperature of the engine coolant.

Fuel Consumption per 10 *km* with Load, *lit*

Highway	95 to 100
Primitive road	100 to 120
Cross-country	130 to 150
Water operation for 1 *hr*	25

The carrier is furnished with a metal-framed canvas cover which is intended for protecting the vehicle only during railway shipment or stationary storage.

Instructions for using the case are given on p. 82.

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CARRIER ATTENDANCE

The carrier attendance includes:

1. Fuel, oil and coolant servicing.
2. Maintenance service.

Upon returning to the park, the carrier should be cleaned and washed. Do not perform maintenance operations on the carrier when it is dirty.

FUEL, OIL AND COOLANT SERVICING

Fuel Filling and Draining

The carrier operates on high-speed diesel fuel. The choice of the summer or winter grades of fuel is determined by the ambient air temperatures. Use the summer grade at an air temperature of not below +5°C and the winter grade at temperatures from +5°C to —30°C.

In case of lower temperatures blend the diesel fuel with low-octane tractor kerosene or use a special arctic grade (see ЯМЗ Engine Technical Manual). As an exception, winter fuel may be used in summer.

To fill tanks with fuel, proceed as follows:

1. Remove the centre front floor section.
2. Make the fuel tank filler neck free from dirt.
3. Unscrew the filler neck plug.

Feed fuel into the tank by using the filling pump (see "Purpose and Operation of Filling Pump" Section). Allow 5 to 6 litre space in the tank.

During the filling operation take care to prevent entry of water into the fuel tanks. Water present in the fuel tanks may cause engine conk in summer weather, whereas in winter it may stop the engine completely due to formation of ice locks.

Check the fuel level in the tanks by the use of the fuel gauge and dip sticks provided on each tank.

To drain fuel, proceed as follows (Fig. 2):

1. Unscrew the bolts of hatch cover *10* located on the carrier bottom under the fuel tank and remove the hatch cover.
2. Unscrew drain plug *3* located in the fuel tank sump.

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3. Install the drain hose (included in the maintenance kit) so that its nipple is screwed into the drain hole. The nipple will raise the drain valve ball and the fuel will flow through the hose into the vessel provided for the purpose.

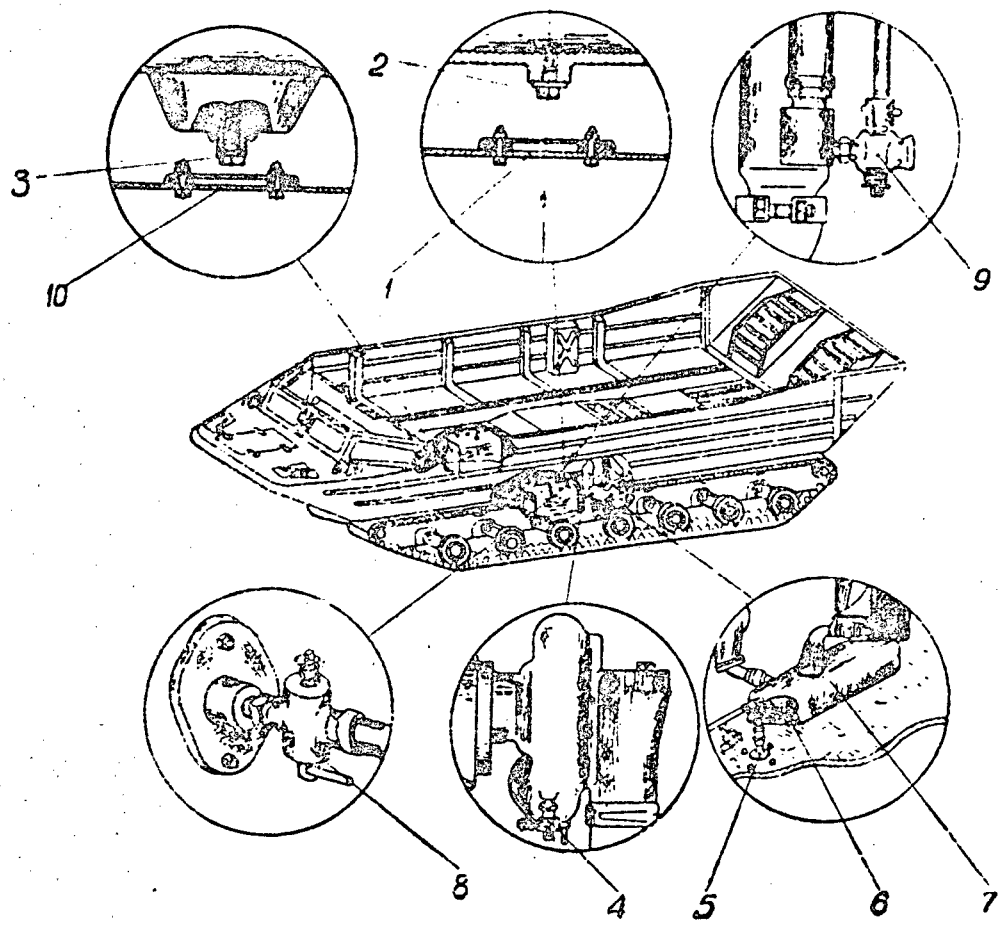

Fig. 2. Fuel, lubricant and coolant drainage:
1—hatch cover; *2*—drain plug; *3*—sump drain plug; *4*—water pump cock; *5*—drain screen; *6*—cooling system drain cock; *7*—heat exchanger; *8*—cylinder block cooling system drain cock; *9*—preheater drain cock; *10*—hatch cover

Filling and Draining Engine Crankcase

The ЯАЗ-М204ВКр engine uses diesel lubrication oil (see ЯМЗ Engine Technical Manual).

In summer temperatures (above +5°) use grade Дп-11 oil with ЦИАТИМ-339 or АЗНИИ—ЦИАТИМ-1 additive.

In winter temperatures (below +5°) use grade Дп-8 oil with ЦИАТИМ-339 or АЗНИИ—ЦИАТИМ-1 additive.

To fill the engine crankcase with oil, proceed as follows:

1. Open the engine hood and clean the filler neck.

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2. Remove the filler neck plug and fill the system with oil.

3. The crankcase dip stick is marked "нижн." ("empty") and "верхн". ("full"). Fill the crankcase until oil level reaches the "full" mark.

4. Start the engine and run it at idle speed for 1 or 2 *min* so that the oil fills the oil filters.

5. Stop the engine, wait 2 or 3 *min* and recheck oil level. Fill up to the "full" mark on the dip stick.

To drain oil from the engine crankcase, proceed as follows:

1. Remove hatch cover *1* located in the carrier bottom under the engine crankcase.

2. Screw drain plug *2* out of the engine crankcase and drain oil into an appropriate vessel. Before draining, warm up the engine to a temperature of 80 to 85°C.

3. Upon draining oil, reinstall the crankcase drain plug and the hatch cover.

4. Drain oil from the oil filters and wash the filters.

Coolant Filling and Draining

For cooling the engine use soft clean water or grade 40 antifreeze solution.

To fill the cooling system, proceed as follows:

1. Remove the engine hood.

2. Remove the radiator cap and place a funnel in the radiator filler neck.

3. Shut off the water pump drain cock and engine preheater drain cock.

4. Shut off the cooling system drain cocks located on the heat exchanger and cylinder block.

5. When filling the cooling system with water, pour water until it is level with the lower end of the radiator filler neck. When using antifreeze, fill the system so that the antifreeze level is 50 to 60 *mm* below the lower end of the filler neck.

The cooling system draining procedure is as follows (Fig. 2):

1. Remove the engine hood.

2. Remove the radiator cap.

3. Turn on cooling system drain cock *6* (located on the heat exchanger) as far as it will go. If the coolant does not come out, clean drain screen *5* located in the left-side passage.

4. Turn on water pump cock *4* and drain coolant from the pump.

5. Turn on cock *9* and drain coolant from the preheater.

6. Turn on cock *8* and drain coolant from the cylinder block.

7. After draining turn the crankshaft to force the remaining coolant out of the pump body.

In cold weather leave the engine with all the cocks turned on and the radiator cap removed.

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MAINTENANCE

1. Inspection.
2. Daily maintenance.
3. Maintenance No. 1.
4. Maintenance No. 2.

Strictly keep to the inspection periods and completely carry out the services prescribed herein.

BEFORE-OPERATION AND AT-HALT SERVICE

A. Before Operation Service

Perform the service before every run of the carrier. Service time is 15 to 20 *min.*

No.	Name of part or unit	Service	Remarks
1	Cooling system	Check water or antifreeze level. Add if necessary	When system is full, water should be level with lower end of filler neck, antifreeze level should be 50 to 60 *mm* below lower end of filler neck
2	Lubrication system	Check oil level in engine crankcase. Add, if necessary	Fill crankcase until oil level reaches upper mark on dip stick. Before refilling run engine at idle speed for 1 or 2 *min*. Do not run engine if oil level is below lower mark on dip stick
3	Fuel system	Check fuel level in tanks	Refill, if necessary
4	Transfer case and axle drive	Check lubricant in transfer case and axle drive	Check oil level in axle drive and fuel level in tanks without screwing in dip stick head
5	Engine	Start engine, observe instrument readings and check engine operation throughout full range of throttle	
6	Screws	Engage screws in 3rd gear and check their operation at 1200 *r.p.m.* engine speed for 30 *sec*	
7	Fuel, lubrication, cooling and exhaust systems, seals in transmission units	Check seals and pipe line joints for oil, fuel and coolant leaks. Check manifold flanges and exhaust pipe joints for gas leaks. Correct defects, wipe dry	
8	Electrical equipment	Check storage battery voltage, external and internal lighting	Close ground circuit. Depress voltameter button and at the same time energize starter for 5 *sec* without feeding fuel to engine. If batteries are normally charged, voltameter should read not less than 18 *V*

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№	Name of part or unit	Service	Remarks
9	Radio set	Check for serviceability in accordance with radio set service instructions	
10	Control linkage	Check operation of control levers and pedals and rudder controls	
11	Hull	Check drop gate latches, windshield latches and seals and winch hatch latch for proper condition. See that hull bottom hatches and plugs are in place and tight. See that track arm rubber plugs are present and drain cock is securely closed	
12	Surge baffles	Check for serviceability and proper attachment	
13	Tracks	Check for tension. Inspect condition of track links and track link pins	When upper stretch of correctly adjusted track is tightened, one or two track links should lie flat at front road wheel. Drive home extending pins and flatten up their ends. Replace cracked track links
14	Maintenance kit	See that maintenance kit and life-saving appliances are present	

Note. When carrying loads see that they are securely fastened.

B. At-Halt Service

Make the first inspection in 1 hour after the commencement of the travel. Then inspect every 50 *km*, but not less than every two hours of travel. Service time is 10 to 15 *min*.

№	Name of part or unit	Service	Remarks
1	Lubrication and cooling systems	Check pipe lines for oil and coolant leaks. Correct faults disclosed. If leaks have been found check oil and coolant levels. Refill if necessary	
2	Gearbox, axle drive, transfer case, final drives, road wheels, idler wheels	Hand-feel for heating. Look for lubricant leaks	

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No.	Name of part or unit	Service	Remarks
3	Tracks	Check for proper condition. Drive home extending pins and flatten their ends. Replace cracked track links. Adjust tracks if necessary	
4	Steering clutches	Give two turns to lubricators provided on steering clutches and drum sleeves	
5	Maintenance kit and equipment	Check for secure fastening	

C. At-Halt Service during Prolonged Water Operation

Inspect every two hours of operation in water without landing. Service time is 10 to 15 *min.*

1	Lubrication and cooling systems	Check crankcase oil level and coolant level in radiator	Refill if necessary
2	Gearbox, transforcase, screw shaft front bearings	Hand-feel for heating	
3	Rudder control	Check rudder control cable tension	
4	Drainage system	Clean intake strainers	

Note: When carrying loads see that they are securely fastened.

D. Service after Prolonged Water Operation
(over 30 *min*)

Inspect at the earliest opportunity after landing.
Service time is 10 to 15 *min.*

1		Drain water from carrier hull through drain valve	
2	Final drive	Look for water	After 5—8 *min* halt remove drain plugs. Drain trapped water until oil shows. During earliest scheduled maintenance remove the defects and change oil, then pay close attention to the final drive operation
3	Screws and rudders	Inspect screws and rudders	
4	Hull and drop gate	Inspect hull and drop gate for damage and holes	

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DAILY MAINTENANCE

Perform routine maintenance daily after every run of the carrier irrespective of the number of operating hours and distance covered. Service time is 2 to 3 hours.

No.	Name of part or unit	Service	Remarks
1	Fuel, lubrication and cooling systems	Inspect connections and pipe lines, correct defects disclosed. Refill with fuel, oil and water as prescribed under "Fuel, Oil and Coolant Servicing".	
2	Hull	Make external inspection. Check whether all hull bottom hatch covers and plugs are present and securely tightened. Check that latches and seals of drop gate, winch hatch and windshield are serviceable. Check that head lamps, horn, marker lamps and life-saving appliances are in good condition and securely held in place. See that maintenance kit items are present, in proper condition and securely fastened	
3	Track assembly	Check tracks and adjust if necessary. Inspect support slides for proper condition	
		Check that lubrication hole plugs are present on road and idler wheels and tigtened up. See that rubber plugs are present on suspension arms. Look for lubricant leaking through wheel road seals and covers. Pry road wheels to check torsion bars for serviceability	Make external inspection without disassembly If oil leaks have been found, refill
4	Engine compartment	Inspect units using service lamp Correct defects found. In case of dusty conditions wash air cleaner. Check fan and generator belt tension. Listen to engine operation and observe engine instruments	Pay attention to condition of safety wire and locking of bolts. If correctly adjusted, fan and generator belts should deflect 12 to 15 *mm* and 10 to 15 *mm* respectively when subjected to 8 *kg* load midway between pulleys
5	Driver's compartment	Check that pivot pins in control linkage, pedals levers are cottered and all joints are secure	
		Check free travel of engine clutch pedal	This should be from 20 to 50 *mm*. Adjust if incorrect
		Check free travel of steering clutch and brake control levers	This should be from 20 to 50 *mm*. Adjust if incorrect

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No.	Name of part or unit	Service	Remarks
		Close ground circuit and check performance of lighting equipment, windshield wipers and horn. Check storage battery voltage	Close ground circuit, depress voltameter button and at the same time energize starter for 5 *sec* without feeding fuel to engine. If storage batteries are normally charged, voltameter should read not less than 9 *V*
		Check that wires are securely connected to storage batteries	
6	Screws and rudders	Check condition of safety bolts on screw shaft front bearings	If cables are adjusted correctly, each stretch between two adjacent frames should have deflection of not over 10 *mm* when subjected to 2.5 *kg* load midway between frames
		Look for lubricant leaking from screw shaft bearing glands. See that plugs are present in lubrication holes	
		Check rudder control cables for correct tension	
7	Cargo compartment	Inspect floor beams, drop gate and ramps	
		Check for cracks, holes and other defects impairing floor strength	
8		Lubricate other carrier units in keeping with Lubrication Chart	

MAINTENANCE No. 1

Perform this service every 25 to 30 hours of the engine operation or every 500 *km*. Service time is 10 to 12 hours.

Maintenance No. 1 includes all the daily maintenance operations and, besides, the following procedure:

1	Fuel system	Refill	Before refilling fuel tanks, drain 5 to 10 *lit* of fuel sediment from each tank by using drain plugs. If sediment does not contain water, filter it and pour into tank
2	Track assembly	Disconnect track. Jack up right and left sides in turn. Check end play, condition of rubber, seals of road and idler wheels	If play is found, remove road wheel cap, check whether wheel is properly cottered and wheel shaft nut is tightened up
		Check arms, stops, bumpers, final drives, sprocket rings, road and idler wheels to see they are in good condition and properly attached	Make external inspection without disassembling
3	Engine compartment	Check propeller shafts for free play of oykes. Check that engine, transfer case, axle drive, hand-operated fuel	

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No.	Name of part or unit	Service	Remarks
		supply pump, screw shaft front bearings and winch are securely attached	
		Check final drive bevel bearings for free play	Adjust bearings, if necessary
		Check for even clearance between brake band and drum, with brake released. Inspect radiator cap. In case of dusty operating conditions, remove dirt from cooling system radiator core	Adjust clearance if spaces less than 0.5 *mm* are found
		Check that fan is in good condition and securely attached	
		Check that starter, generator, storage batteries and their associated wiring are securely attached	
		Check that pick-up units of oil pressure gauge, fuel level gauge, temperature gauge, speedometer and tachometer are securely attached	
		Start engine and warm it up to 70°. Drain oil from engine crankcase, flush crankcase and fill with fresh oil	
		Wash preliminary and final fuel filters and preliminary oil filter. Wash air cleaners	Wash filters in diesel fuel or kerosene If final fuel filter element is found deteriorated, replace it
		Start engine and check for oil, fuel and coolant leaks and for gas leakage at maninfold flanges and cylinder head gasket. Observe reading of instruments	Correct faults detected
4	Driver's compartment	With carrier in motion check operation of controls of gearbox, transfer case, engine clutch, steering clutches and brakes	Correct faults
		Check condition of shifter gate and see that radio set is securely attached	
5	Screws and rudders	Check screws and rudders for proper condition	Correct faults
		Check that steering wheel bracket and steering wheel are properly attached and screw gland nuts are tightened up and locked in place	
		Inspect rudder control cables for proper condition	

No.	Name of part or unit	Service	Remarks

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No.	Name of part or unit	Service	Remarks
6	Cargo compartment	Check condition of platform, special system securing fixture, latches and seals of drop gate Check floor beam to frame attachment	
7		Lubricate carrier units as prescribed in Lubrication Chart	

MAINTENANCE No. 2

Perform this service every 50 to 60 hours of the engine operation or every 1,000 *km*. Service time is 14 to 16 hours.

Maintenance No. 2 inludes all operations prescribed for maintenance No.1 and, besides, the following procedure:

1	Engine compartment	Check generator and starter for proper attachment. Check condition of generator and starter brushes Check that nuts holding exhaust manifold, exhaust pipes and muffler are tightened up Check drainage pumps and suction intakes for proper condition and secure attachment Replace filter elements in final fuel filter, preliminary fuel filter and final oil filter Wash fuel tank filter strainer in diesel fuel or kerosene Check valve to rocket arm clearances. Gauge-check setting of pump and injector units Remove heat exchanger and clean out cooling pipes through removable hatches	
2	Driver's compartment	Check that winch cable is in good condition, electric wiring is in good condition and securely connected, seals of winch hatch and windshield are in good condition Check storage batteries for voltage, check level and density of electrolyte	
3	Cargo compartment	Inspect special system and truck securing fixtures	Correct faults

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Lubricate carrier units as prescribed in Lubrication Chart. In addition to the above operations, do the following:

1. Every 100 to 120 operating hours or every 2,000 *km*: a) check that the scavenge ports are clean; b) check the cylinder head nuts for correct tension.

2. Every 200 to 240 operating hours or every 4,000 *km*: a) wash oil pump intake; b) perform preventive maintenance service on starter.

3. Every 400 to 480 operating hours flush engine oil cooler.

After 2,000 *km* of Operation, in Addition to Maintenance No. 2 Do the Following:

1. Drain oil from the transfer case and the gearbox. Wash the housings of these units with diesel fuel or heated oil. Fill the transfer case with fresh oil until oil level reaches the dip stick upper mark. Fill the gearbox with fresh oil until oil level reaches the check hole.

2. Change lubricant in the road and idler wheels.

3. Every 250 operating hours remove the generator, detach the pulley, front and rear flanges. Lubricate the bearings with HK-50 aviation lubricant.

Changing Oil in Power Transmission Units

a) As a rule, change oil immediately after the day's run has been completed without permitting the units to cool down. If necessity arises to change oil when the power transmission units are cool, before draining the used oil warm up the units to 40—50°C by running them idle (with the tracks disconnected and removed from the sprockets) or by giving the carrier a short drive.

b) Drain the used oil completely. Screw in the drain plugs and fill the unit housing with diesel fuel, approximately $^3/_4$ of the oil capacity

c) Flush the housing with the diesel fuel by running it idle for 30 to 40 *sec* with the gearbox in the second gear. (When running the transfer case, the control lever "ВИНТЫ-ГУСЕНИЦЫ" ("screws and tracks") should be in the "ВИНТЫ" ("screws") position).

d) Drain the diesel oil completely, install the drain plugs and fill the housing with fresh oil.

e) Run the unit idle for 2 or 3 *min* with the gearbox in the third gear.

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LUBRICATION INSTRUCTIONS

General Instructions

1. The lubricant must be clean and free from foreign matter such as water, mechanical particles, etc.

2. Before applying lubrication compounds, mix them up thoroughly to obtain uniform substance.

3. In winter weather warm up the lubricant.

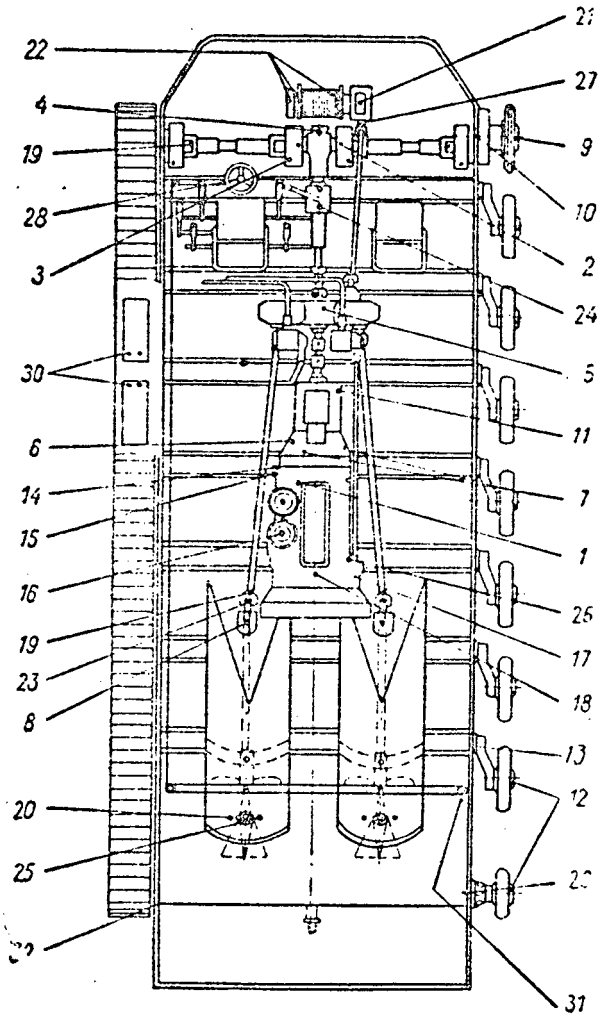

Fig. 3. Diagram showing lubrication points:
1—engine crankcase; *2*—steering clutch release bearings; *3*—steering clutch sleeves; *4*—axle drive housing; *5*—transfer case housing; *6*—engine clutch release bearing; *7*—engine clutch release fork shaft; *8*—screw shaft bearings; *9*—track drive sprocket; *10*—final drive housing; *11*—gearbox housing; *12*—road and idler wheels; *13*—arm shaft; *14*—starter pinion; *15*—starter bearing; *16*—air cleaner; *17*—fan tension pulley shaft; *18*—fan bearing; *19*—universal joint centre crosses; *20*—rudder upper bearing; *21*—winch housing; *22*—winch shaft support and winch drum; *23*—screw shaft protective sleeve; *24*—gear shaft gate sleeve; *25*—lower supports; *26*—generator bearing; *27*—control linkage joints; *28*—steering column sleeves; *29*—idler wheel bracket; *30*—storage battery terminals; *31*—roller and control linkage cable sleeves; *32*—drop gate hinges

4. In winter weather check lubricant level and replenish it as soon as the run has been completed without permitting the mechanisms to cool down.

5. All the lubrication points are shown in Fig. 3.

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LUBRICATION CHART

A. Daily Maintenance

Lubrication point No.	Part name	Q-ty of lubrication points	Grade of lubricant		Remarks
			summer	winter	
1	Engine crankcase	1	Дп-11 diesel oil with ЦИАТИМ-339 or АЗНИИ-ЦИАТИМ-1 additive	Дп-8 diesel oil with ЦИАТИМ-339 or АЗНИИ-ЦИАТИМ-1 additive	Check with dip stick. Fill to dip stick upper mark
2	Steering clutch release bearings	2	Constaline	Constaline	Pack 1 or 2 lubricator capfuls. Upon packing install lubricator cap so that leather washer enters cap thread
3	Steering clutch sleeves	2	Constaline	Constaline	Pack 1 or 2 lubricator capfuls. Upon packing install lubricator cap so that leather washer enters cap thread
4	Axle drive housing	1	MT-16-п oil	MT-16-п oil	Check with dip stick. Fill to dip stick upper mark
5	Transfer case housing	1	MT-16-п oil	MT-16-п oil	Check with dip stick Fill to dip stick upper mark
			In case of water operation also lubricate:		
8	Screw shaft bearings	4	Solid oil, grade "Л" or "Т"	50% grade "Л" or "Т" solid oil to 50% engine oil	Pack full
9	Track drive sprocket	2	Grade "Л" or "Т" solid oil	50% grade "Л" or "Т" solid oil to 50% engine oil	Pack until fresh grease shows
29	Idler wheel bracket	2	Grade "Л" or "Т" solid oil	50% grade "Л" or "Т" solid oil to 50% engine oil	Pack until fresh grease shows

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B. Maintenance No. 1

(to be performed in addition to daily maintenance lubrication)

Lubrication point No.	Part name	Q-ty of lubrication points	Grade of lubricant		Remarks
			summer	winter	
1	Engine crankcase	1	Дп-11 diesel oil with ЦИАТИМ-339 or ЦИАТИМ-АЗНИИ-1 additive	Дп-8 diesel oil with ЦИАТИМ-339 or ЦИАТИМ-АЗНИИ-1 additive	Drain used oil. Flush crankcase with heated diesel oil. Fill with fresh oil to dip stick upper mark
9	Track drive sprocket	1	Grade "Л" or "Т" solid oil	50% grade "Л" or "Т" solid oil to 50% engine oil	Pack until fresh grease shows
21	Gear shift gate sleeve	1	Grade "Л" or "Т" solid oil	50% grade "Л" or "Т" solid oil to 50% engine oil	Pack until fresh grease shows
10	Final drive housing	2	ЦИАТИМ-208 lubricant	ЦИАТИМ-208 lubricant	Fill to check hole
11	Gearbox housing	1	МТ-16-п oil	МТ-16-п oil	Fill to check hole
12	Road and idler wheels	16	Grade "Л" or "Т" solid oil	50% grade "Л" or "Т" solid oil to 50% engine oil	Pack full
13	Arm shafts	14	Grade "Л" or "Т" solid oil	50% grade "Л" or "Т" solid oil to 50% engine oil	Pack until fresh grease shows
14	Starter pinion	1	Engine oil	Engine oil	Unscrew flywheel housing plug, move latch aside and give 4 or 5 drops
15	Starter bearing	2	Engine oil	Engine oil	Move latch aside, give 4 or 5 drops
16	Air cleaner	2	МТ-16-п oil	МТ-16-п oil	Drain oil, wash cleaner, fill with fresh oil to mark
17	Fan tension pulley shaft	1	Constaline	Constaline	Pack until fresh grease shows

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Lubrication point No.	Part name	Q-ty of lubrication points	Grade of lubricant		Remarks
			summer	winter	
18	Fan bearing	1	Constaline	Constaline	Pack until fresh grease shows
19	Universal joint centre crosses	20	MT-16-n oil	MT-16-n oil	Pack until fresh grease shows from check valve
20	Rudder upper bearing	2	Grade "J" or "T" solid oil	50% grade "J" or "T" solid oil to 50% engine oil	Pack until fresh oil shows
21	Winch housing	1	MT-16-n oil	MT-16-n oil	Fill to check hole
22	Winch shaft support and winch drum	3	Grade "J" or "T" solid oil	50% grade "J" or "T" solid oil to 50% engine oil	Pack until fresh grease shows
6	Engine clutch release bearing	1	Constaline	Constaline	10 gun shots
7	Engine clutch release fork shaft	2	Constaline	Constaline	10 gun shots
30	Storage battery terminals	4	VH petrolatum	VH petrolatum	Apply thin coating
27	Control linkage joints		Used engine oil		Used engine oil
28 31 25	Steering column sleeves, steering roller sleeves rudder lower supports		Any liquid lubricant used on carrier		Use oil can
32	Drop gate hinges				
29	Idler wheel bracket		Grade "J" or "T" solid oil	50% grade "J" or "T" solid oil to 50% engine oil	Pack until fresh grease shows

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C. Maintenance No. 2

(to be performed in addition to Maintenance No. 1 Lubrication)

Lubrication point No.	Part name	Q-ty of lubrication points	Grade of lubricant: summer	Grade of lubricant: winter	Remarks
4	Axle drive housing	1	MT-16-п oil	MT-16-п oil	Drain used oil. Flush housing with diesel fuel or heated oil. Fill with fresh oil to dip stick upper mark
10	Final drive housing	2	ЦИАТИМ-208 lubricant	ЦИАТИМ-208 lubricant	Drain used oil. Flush housing with diesel fuel or heated oil. Fill with fresh oil to check hole
23	Screw shaft protective sleeve. Hinges of windshield, seats and winch hatch	2	Grade "T" or "T" solid oil	50% grade "T" or "T" solid oil to 50% engine oil Any liquid lubricant used on carrier	Pack until fresh grease shows

NOTES: 1. MT-16-п oil prescribed for summer use in Items 4 and 5 may be replaced by summer automotive transmission oil. MT-16-п oil prescribed for summer use in Items 11 and 16 may be replaced by MK-22 aviation oil. MT-16-п oil prescribed for winter use in Items 4, 5, 10, 11 and 16 may be replaced by MC-14 aviation oil. MT-16-п oil prescribed for summer and winter use in Items 19 and 21 may be replaced by summer automotive transmission oil.

2. To lubricate the generator bearing, use ЦИАТИМ-201 lubricant.

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OPERATING CARRIER

GENERAL INSTRUCTIONS

To be permitted to drive the carrier, the personnel involved should be appropriately trained, have the knowledge of the carrier material, maintenance and operation, possess a tracked vehicle driving licence of at least the 2nd class and be familiarized with the regulations for operating amphibious vehicles.

When operating the carrier, the driver must observe the driving regulations, see that the engine is not overloaded and shift into a lower gear if the engine speed decreases at full fuel delivery.

When overcoming obstacles, the driver must faithfully follow the instructions given below:

1. Approach the obstacle squarely and in the gear so selected as to cross the obstacle without stopping.
2. When overcoming obstacles, avoid turning, gear shifting and stopping.

Closely watch the readings of the instruments indicating the engine operation. If the instruments indicate improper operation or undue noise is heard in the engine or other units, stop the carrier immediately, find the source of the trouble and take measures to eliminate it. During night driving the carrier marker lights must be on.

GETTING CARRIER READY TO OPERATE

Inspect the carrier each time before starting the run.

A. Getting Engine Ready to Start

To get the engine ready to start, proceed as follows:

1. Perform oil, fuel and coolant servicing.
2. In cold weather close the radiator shutters.
3. Turn the fuel shut-off valve fully on.
4. Feed fuel to the engine by operating the hand pump.
5. Shift the gearbox control lever into neutral.
6. Shift the "screws and tracks" control lever into the "ГУСЕНИЦЫ" ("tracks") position.
7. Shift the propulsion screw control lever into "нейтральное" ("neutral") position.

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8. Shift the winch control lever into the "выключено" ("off") position.

9. Close the ground circuit.

B. Starting Engine

To start the engine, proceed as follows:

1. Sound the horn.
2. Depress the engine clutch pedal.
3. Depress the accelerator pedal and at the same time depress the starter button.
4. After the engine has started firing, gradually release the engine clutch pedal.
5. Using the hand throttle lever set the engine speed at about 1,000 *r.p.m.*
6. Run the engine at this speed for 4 or 5 *min.* Then speed up to 1,300 *r.p.m.* and warm up the engine until the coolant temperature is 70 to 75°.

Do not crank the engine with the starter for more than 20 to 25 sec at a time. Wait at least 1 or 2 min before reengaging the starter. If four attempts to start the engine have failed, investigate the cause of the trouble and eliminate it.

For engine starting procedure in winter weather see pp... 65-68.

C. Use of Instruments

Watch the engine performance by observing the readings of the instruments.

When the engine is warmed up, the oil pressure gauge should read at least 1.7 *kg/sq.cm* at 2,000 *r.p.m.* and at least 0.3 *kg/sq.cm* at idle speed (450 to 500 *r.p.m.*).

The coolant temperature is indicated by the vapour pressure thermometer and should be from 75 to 90°.

The storage battery charge is indicated by the voltameter. The battery current should be from 3 to 16 *A* depending on the battery charge.

If the voltameter pointer reads zero at 1,450 *r.p.m.* of the engine speed, switch on all the lighting equipment to check the generator performance. If the pointer returns to zero, this will indicate that the batteries are fully charged and the generator functions properly.

If the voltameter reads discharging find and eliminate the fault.

While in motion keep the engine speed under load within the range of 1,200 to 2,000 *r.p.m.*

If the engine speed drops at full fuel delivery due to increased load, shift into a lower gear.

If the tachometer reads over 2,250 r.p.m., immediately stop the engine and do not start it until the cause of overspeed is found and eliminated.

Do not run the engine idle for a long time.

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D. Stopping Engine

Before stopping the engine it is advisable to slow down the engine speed to 1,200 *r.p.m.* and to allow the engine to run under no load for 2 or 3 *min.* Then remove your foot from the accelerator pedal and shift the hand throttle lever upward as far as possible to set the fuel delivery to a minimum. Next stop the engine by shifting the fuel cut-off lever downward. When the engine has stopped, close the fuel shut-off valve.

If the engine starts racing at the minimum fuel delivery, stop it immediately by using the emergency stopping arrangement. For the purpose shift the fuel cut-off lever all the way down.

Use the emergency stopping only under emergency circumstances, as this causes great overstrain on the engine parts and excessive carbon formation.

LAND OPERATION OF CARRIER

Start moving in lower gear. To avoid rapid wear and heating of the engine clutch disc, do not allow excessive clutch slipping at starting from rest, particularly under heavy road conditions. Start the carrier smoothly, with no jerks. Do not rest your foot on the engine clutch pedal while in motion.

A. Starting Carrier

The choice of the gear at starting the carrier on level ground depends on the kind and condition of the terrain.

Start in the second gear on dry and hard ground.

Start in the first gear in soft ground (sand, mud, deep snow).

To start the carrier:

1. Depress the engine clutch pedal.
2. Shift into the required gear in 3 to 5 *sec* after the engine clutch has been disengaged.
3. Sound the horn.
4. Rapidly and smoothly release the engine clutch pedal, and at the same time depress the accelerator pedal.

To start the carrier under heavy road conditions, proceed as follows:

1. Depress the engine clutch pedal.
2. Shift into the first gear.
3. Disengage the steering clutches by pulling their control levers towards you as far as they will go.
4. Release the engine clutch pedal.
5. Rapidly and smoothly release the steering clutch levers, and at the same time depress the accelerator pedal.

To start the carrier braked uphill, proceed as follows:

1. Depress the engine clutch pedal.
2. Shift into the first gear.

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3. Release the engine clutch pedal.

4. Rapidly and smoothly release one steering clutch lever. As soon as the slightest movement of the carrier is felt, rapidly release the other steering clutch lever, and at the same time increase fuel delivery. If the attempt to start results in the carrier backing downhill, depress the engine clutch pedal and promptly apply the brakes to avoid damage to the transmission units. Repeat the starting only after the carrier has been brought to a complete stop.

In the event the tracks are slipping, proceed as follows:

1. While applying the brakes, depress the engine clutch pedal.
2. Shift into the reverse gear.
3. Release the engine clutch pedal.
4. Smoothly and rapidly release the steering clutch levers and cautiously start reversing. If the engine speed increases apply the right-hand and the left-hand brakes alternately. Bear in mind that abrupt braking may cause skidding, which is particularly dangerous on slopes. Choose another way for a repeated climbing.

To start the carrier on a descent, proceed as follows:

1. Depress the engine clutch pedal.
2. Shift into the required gear.

When starting from rest on a steep and long slope, engage the first gear. While going downhill, apply the brakes as necessary.

When moving down a short steep grade, the second or third gear may be used. While in motion, apply the brakes and do not allow the engine to speed up to 2,250 *r.p.m.*

3. While releasing the steering clutch and brake levers, release the engine clutch pedal.

B. Stopping Carrier

For an emergency stop, proceed as follows:

1. Rapidly release the accelerator pedal.
2. Rapidly pull the steering clutch and brake levers towards you until the brake application is felt, next continue pulling the levers slowly until the brakes are applied fully.
3. Depress the engine clutch pedal.
4. If the road is even, shift the steering clutch and brake levers into the initial position.
5. Shift the gearbox lever into neutral.
6. Release the engine clutch pedal.

For an intended stop, proceed as follows:

1. Decrease fuel delivery.
2. Depress the engine clutch pedal and release the accelerator pedal.
3. Shift the gearbox lever into neutral.
4. Release the engine clutch pedal.
5. Coast to the desired point and apply the brakes if necessary.

To stop when going up or down hill, proceed as follows:

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1. Release the accelerator pedal.

2. Depress the engine clutch pedal and at the same time apply the brakes to bring the carrier to a complete stop.

Lock the steering clutch and brake levers in place.

3. Shift the gearbox levers into neutral.

When operating on steep grades, the secure braking of the carrier should be effected by using the following procedure:

Stop the engine, shift into the appropriate gear (either first or reverse gear) and release one of the steering clutch and brake levers.

C. Gear Shifting

In making gear shifting, follow the instructions given below:

1. Drive in as high gear as possible under the road conditions involved.

2. Select the gear to suit the profile and kind of the terrain.

3. Do not overload the engine. If the engine fails to develop a speed of 1,400 to 1,500 *r.p.m.*, immediately shift into a lower gear.

4. Do not speed up or slow down the carrier abruptly when making a gear shift.

5. Do not change gears while moving up or down a steep grade, over a bog, deep snow, loose soil, obstacles railway crossings, bridges, fords, ice or slippery terrain.

To travel under the above specified conditions, select the required gear beforehand.

6. Shifting directly from the first into the third gear, from the second into the fourth gear and from the third into the fifth gear may be made only when going downgrade.

Shifting directly from the fifth into the third gear, from the fourth into the second gear and from the third into the first gear is allowed under the following conditions:

when approaching difficult terrain (ascent, heavy-going ground, obstacles);

when rapid slowing down necessitates the use of a lower gear.

Shift from a lower to a higher gear, provided there is a reserve of the engine power and the road conditions are suitable. To do this, proceed as follows:

1. Smoothly increasing fuel delivery, speed up the carrier to synchronize its speed with the maximum speed of the engine (2,000 *r.p.m.*).

2. Release the accelerator pedal and at the same time depress the engine clutch pedal.

3. Shift into the next higher gear.

4. Rapidly and smoothly release the engine clutch pedal and at the same time increase fuel delivery.

If the carrier speed slows down and the engine fails to develop a speed over 1,500 *r.p.m.* at the maximum fuel delivery, shift into the lower gear by using the following procedure:

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1. Slow down the vehicle.
2. Release the accelerator pedal while depressing the engine clutch pedal. Move the gearbox control lever into neutral.
3. Release the engine clutch pedal and at the same time depress the accelerator pedal (intermediate fuel delivery).
4. Release the accelerator pedal and at the same time depress the engine clutch pedal. Shift into the lower gear.
5. Rapidly but smoothly release the engine clutch pedal while increasing fuel delivery.

If, when shifting into the lower gear, the vehicle speed decreases sharply, make the shift without intermediate fuel delivery, by using the following procedure:

1. Depress the engine clutch pedal while releasing the accelerator pedal.
2. Rapidly shift into the lower gear.
3. Rapidly but smoothly release the engine clutch pedal and at the same time increase fuel delivery.

D. Steering

General steering instructions are as follows:

1. Move the control levers rapidly but smoothly.
2. Make tight turns only in low gears, completely contracting the brake bands.

To make a smooth turn, apply the control lever of one steering clutch while depressing the accelerator pedal.

3. It is not permissible to make turns in the fourth and fifth gears with the brake bands fully applied.
4. To make a turn, choose, if possible, level hard ground.
5. Avoid turning on steep grades.
6. Do not turn the vehicle when going over a bog, ford or ice.
7. Make turns in sand or loose and deep snow in several steps, making a 3 to 4 *m* straight run after each turning step.
8. Turning in steps should not be employed unless necessary.
9. Avoid making turns when going on gravel or pebble, as the stones may get inside the tracks and cause damage to the wheel tyres or braking of the tracks. Making tight turns on gravel and pebble is not permissible.
10. If the vehicle is skidding, stop turning by moving the control lever all the way forward.

Smooth turning on hard-surface roads or ground is accomplished by merely disengaging the steering clutch on the side corresponding to the direction in which the vehicle is to be turned. If this procedure proves insufficient, rapidly and smoothly brake the track by pulling the steering clutch control lever closer to you.

Make tight turns only in low gears.

Depending on the turning angle, condition and kind of the ground, turning the vehicle may be accomplished by braking in one, two, three or many ' ns.

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Employ single-step braking when operating in low gear on hard ground, making spin turns or large-angle turns.

Employ two-step and three-step braking when operating on medium-hard ground at a speed of not more than 10 to 15 *km/hr.*

Employ multi-step braking when operating on loose ground. Turn the vehicle through a 5 to 10° angle by each braking step.

After each application of the brakes drive the vehicle forward at least half its length.

E. Braking

The carrier can be braked by the use of the engine compression and the brakes.

Braking the carrier by the engine is accomplished by decreasing fuel delivery, the engine clutch and axle drive being engaged. Use the engine to assist in slowing down the vehicle when going in a column, on slippery ground, before stopping as well as before shifting into the lower gear when driving downgrade.

Apply the brakes in case of an emergency or intended stop as well as to stop the vehicle when moving up or down grade.

To apply the brakes, use the following procedure:

1. Release the accelerator pedal.
2. Smoothly pull the steering clutch control levers toward until the vehicle is brought to a complete stop.
3. Depress the engine clutch pedal.
4. Move the gearbox control lever into neutral.
5. Release the engine clutch pedal.

Observe the following braking requirements:

1. When applying the brakes, steer the vehicle so that both tracks have the same traction on the ground.
2. Do not allow the vehicle to slip with the tracks braked.
3. Do not apply the brakes when the vehicle is inclined sideways.
4. Decrease the vehicle speed when descending, turning or operating on slippery terrain.

F. Towing Carrier

The carrier may be towed by towing vehicles as well as by other carriers.

Follow the towing instructions given below:

1. If several vehicles are used to tow the carrier, dispose them tandem.
2. Attach the carrier to the towing vehicle with cables by the use of the carrier front hooks or rear drawbar.
3. If the brakes of the carrier in tow cannot be applied when on a steep descent, the carrier travel downgrade should be assisted by a towing vehicle attached to the rear of the carrier.
4. The carrier transmission should be in low gear when the carrier is being towed. Starting from rest should be smooth, without jerks.

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5. Assist the jammed or disabled carrier by pulling it lengthwise to avoid coming off the tracks.

6. Do not turn the towing vehicle and the carrier in tow simultaneously as this will cause the prime mover engine to stall and result in damage to the prime mover transmission.

7. Application of the brakes on the carrier in tow is permitted only when turning or travelling down long descents. It is not permissible to apply the brakes of the carrier being towed lengthwise or to sharply change the towing speed.

8. The towing vehicle and the carrier are allowed to be stopped simultaneously only on level ground, the speed of both vehicles being gradually reduced.

Do not stop while turning, moving up and down grade or on stickly soil, or when the vehicle is inclined sideways. With the vehicles at rest, the towing cables should slightly sag.

When overcoming short steep ascents or narrow water barriers, use towing cables of sufficient length so that both vehicles are not on the ascent or in water at a time.

WATER OPERATION OF CARRIER

A. Getting Carrier Ready to Enter Water

Before entering water, pack the idler wheel bracket, track drive sprocket and screw shaft bearings with grease as prescribed in the Lubrication Chart make the following checks:

1. Check that all covers and hatch lids are present and tight.
2. Check that the winch upper hatch cover and the windshield are tightly closed and the drain cock is fully shut off.
3. Check that the drop gate seals and latches are in proper condition.
4. Check that the surge baffle securely attached.
5. Check the screws and rudders for proper operation.
6. Check to see that the pump priming strainers and the drainage system intake strainers are clean.
7. Make sure the saving appliances are present and in serviceable condition.
8. Check to see that the winch is disengaged.

B. Entering Water

To enter water, proceed as follows:

1. Move the screw control levers into the "n.x." ("forward") position.
2. Shift into the gear required for the carrier to enter water (depending on condition of the ground and the bank profile).
3. Drive the carrier square with the water border and smoothly enter the water.

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4. As soon as the carrier becomes waterborne, move the "screws" and "tracks" control levers into the "screws" position, shift into the third gear and continue travelling by the use of the screws.

Entering water in reverse is permitted as an exception in the following cases:

a) Forward entering is impossible.

b) On condition that the gradient of the bank and bottom of the water barrier are flat (not more than 5°) and the carrier moves at the minimum engine speed.

C. Water Manoeuvring

Smooth turns of at least 10 to 15 *m* radius are accomplished by means of the rudders controlled through the steering wheel.

Small radius turns are effected by means of the screws in the following manner:

1. Grasp the control lever of the screw corresponding to the direction in which the carrier is to be turned and move it into the "з.х." ("reverse") position.

2. At the same time rotate the steering wheel in the direction of the turn as far as possible.

Do not perform turning manoeuvres if the carrier is coming out of the water and its tracks have touched the ground, part of the hull being in the water.

If the tracks have come in touch with the bottom when the vehicle is moving over a shallow, shift into the second gear, move the "screws and tracks" lever into the "screws and tracks" position and continue travelling by using both tracks and screws and without making turns. If the engine power proves insufficient for such a manner of operation, move the "screws and tracks" lever into the "tracks" position and travel by the use of the tracks alone. After the vehicle has passed the shallow and become waterborne, proceed to travelling by the use of the screws.

To back the carrier in water, place both screw control levers in the "reverse" position. In this case steering the vehicle is effected by the use of the screws.

During normal water operation, the engine speed should be within 1,700 to 1,800 *r.p.m.* and the coolant temperature should be 75 to 95°.

D. Landing

Come out of the water in such a manner that when the tracks come in touch with the ground the vehicle is square with the water border. Take into account the possibility of a drift due to the water current.

As soon as the vehicle has come in contact with the ground, move the "screws and tracks" control lever into the "tracks" position and shift into the gear required for the vehicle to climb up the bank.

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Avoid steering the carrier by the use of the steering clutch levers as this may cause the tracks to come off.

After prolonged operation in water perform services prescribed in the section "Service after Prolonged Water Operation".

Notes:

1. When operating the "screws and tracks" control lever and either of the screw control levers, depress the engine clutch pedal in the same manner as when making gear shifts.

2. The drainage pumps are brought into action automatically when the screws start running. When necessity arises to pump out water without the screws running, move the "screws and tracks" lever into the "screws" position and set the screw control levers into neutral.

USE OF CARRIER

A. Loading and Unloading Operations

To receive the cargo, the carrier should be placed on a flat level ground. For loading and unloading wheeled vehicles open the drop gate and swing down the ramps and the securing fixture.

When performing loading (unloading) operations, see that the ramp ends neither differ considerably in their relative vertical positions nor rest on the ground with one corner.

The vehicles being loaded should be moved only over the bearing section of the drop gate and over the floor beams.

Vehicles may be loaded on the carrier by the use of the carrier winch as well as under their own power.

B. Operating Winch

To engage the winch, proceed as follows:

1. Set the steering clutch control levers so that the brakes are fully applied and lock the levers in position.
2. Depress the engine clutch pedal.
3. Shift the gearbox into the first gear for loading, or into the reverse gear for unloading.
4. Set the "screws and tracks" control lever into the "screws" position and the screw control levers into neutral.
5. Shift the winch control lever into the "включено" ("on") position.
6. Release the engine clutch pedal and, accelerating the engine, smoothly wind (when loading) or pay out (when unloading) the cable.

During the operation of the winch the engine speed should not exceed 1,800 *r.p.m.*

Do not wind the cable under load if there are less than three turns of the cable round the drum. Do not allow the cable turns on the drum to intersect.

The use of the winch is strictly forbidden unless the cable is in good working condition.

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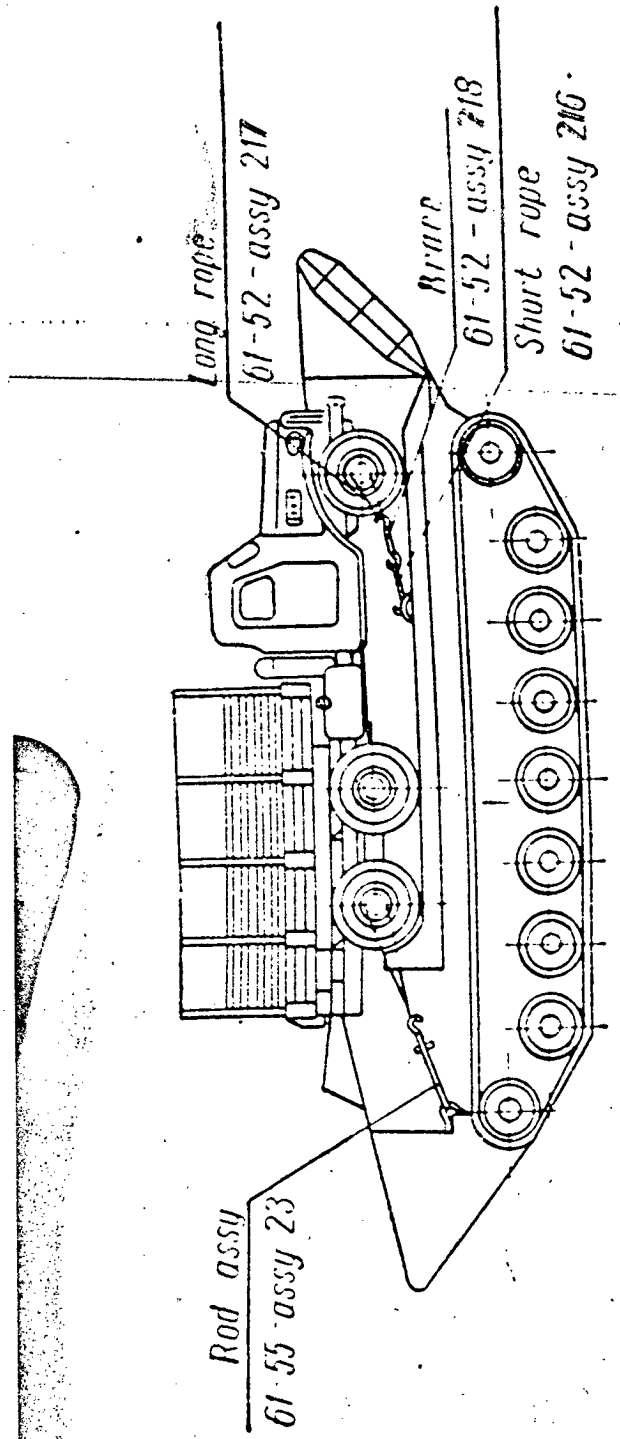

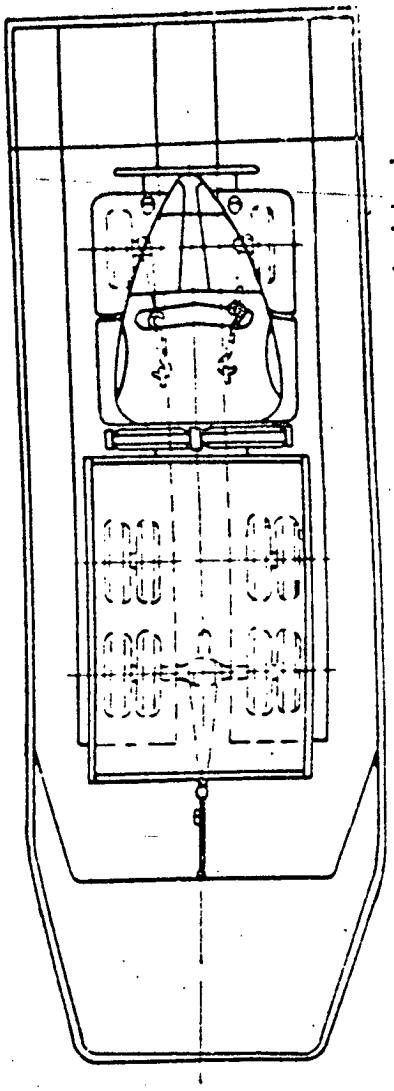

Fig. 4. Securing 311.7-151 or 311.7-157 six-wheel truck

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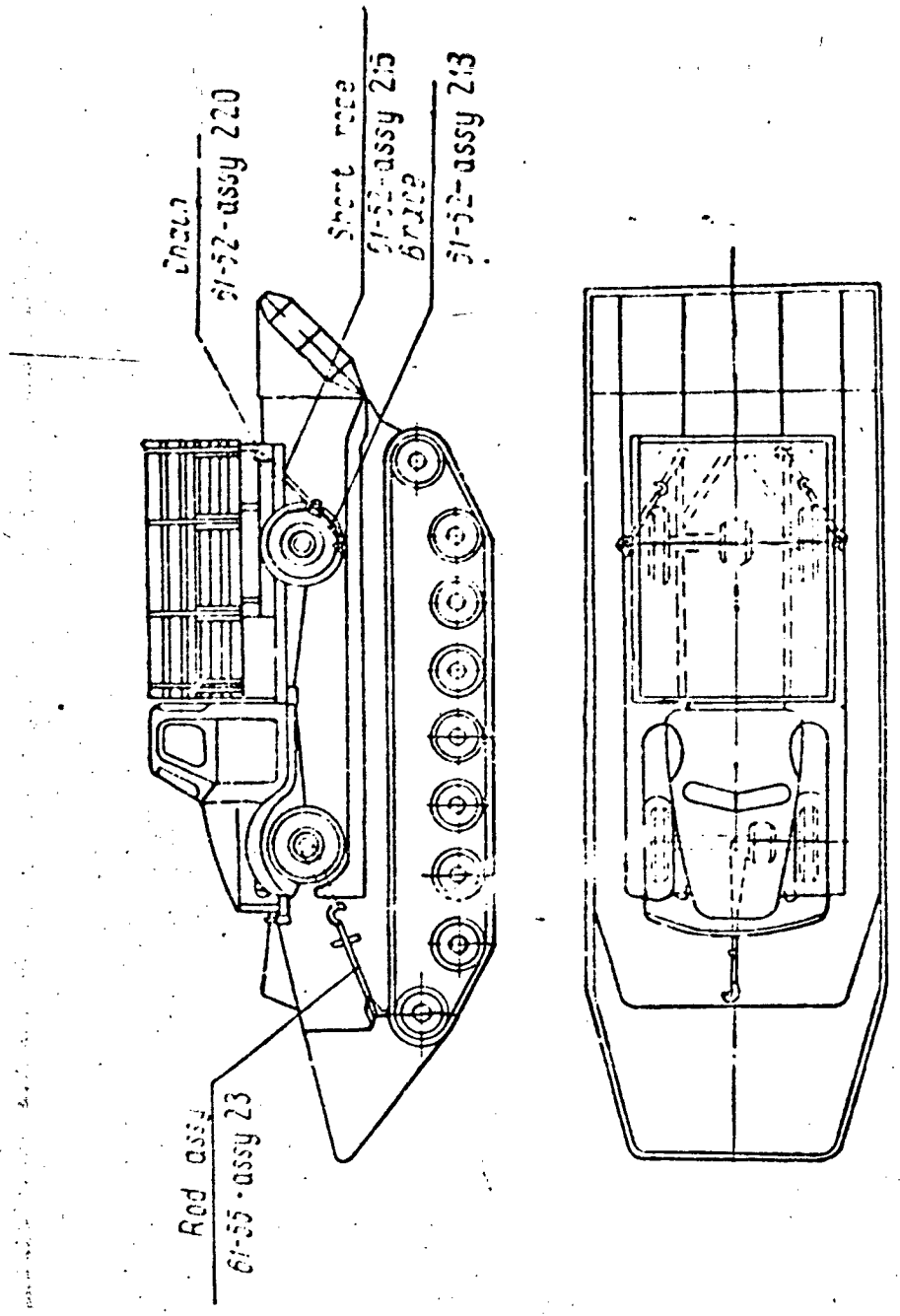

Fig. 5. Securing ГАЗ-63 four-wheel track

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Apply the winch pull until the front (or rear) wheels of the vehicle being loaded bear against the floor beam abutments.

Load six-wheel trucks with the body forward (Fig. 4), load four-wheel truck with the body rearward (Fig. 5).

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Secure the winch cable to the front or rear axle of the truck. As soon as the truck reaches the floor beam abutments, disengage the winch.

C. Securing Trucks on Carrier

Upon completion of the loading close the drop gate. The truck driver should stop the truck engine, shift the truck transmission into the first or reverse gear and apply the hand brake. Disconnect the winch cable from the truck and secure the truck in place by attaching the braces provided for the purpose to the front and rear axles.

While the carrier is in motion, the truck driver should be in the truck cab at the truck controls.

To unload, open the drop gate, swing down the ramps and the securing fixture and remove the braces from the truck.

truck driver should start the truck engine, release the hand brake and smoothly drive the truck down from the carrier, using the first or reverse gear, running the truck engine at the minimum speed and applying the brakes.

D. Loading and Unloading Special Systems

(Fig. 6)

To load the special system use the following procedure:

1. Open the drop gate and swing down the ramps and special system securing fixture.
2. Attach the winch cable to the special system wheel axle.
3. Engage the winch and wind the cable. At this time the special system team should support the special system and direct its wheels into the ramps.
4. When the special system is mounted on the floor beams, close the drop gate. Install the special system securing fixture in position, fix it with two pins and remove the special system securing washer from the fixture.
5. Engage the gearbox reverse gear and pay out the winch cable.

Put the special system towing gear lug on the securing fixture and fasten it with the washer. If the carrier operates under cross-country conditions, the gun attachment should be added with braces provided with the carrier maintenance kit.

6. Disengage the winch, shift the gearbox control lever into the neutral position, shift the "screws and tracks" control lever into the "tracks" position.

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To unload the special system, use the following procedure:

1. The special system team should remove the securing washer from the fixture, move the trail off the fixture and, holding the special system by the trail, move it to the drop gate.

2. Open the drop gate and swing down the ramps and the securing fixture.

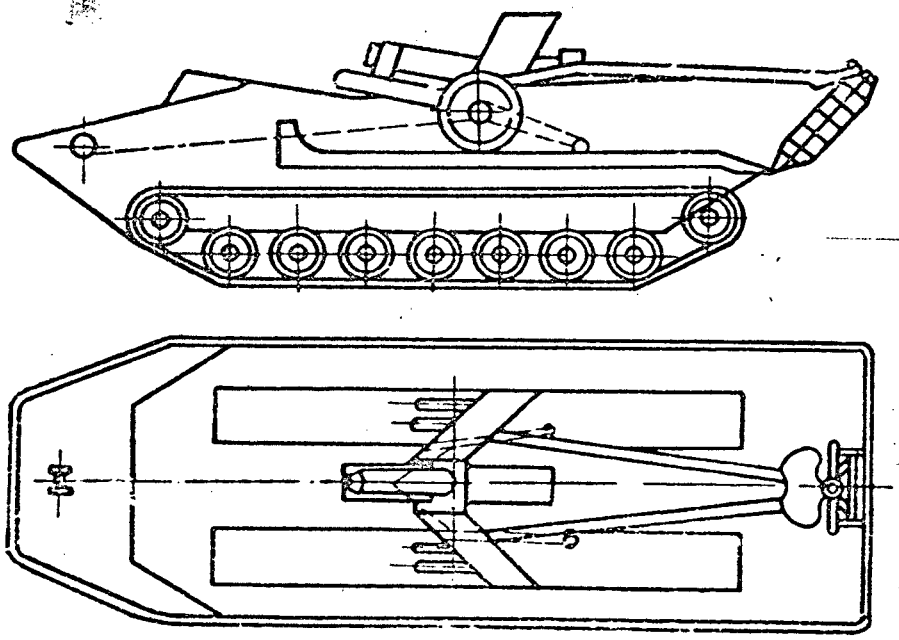

Fig. 6. Securing special system

3. Depress the engine clutch pedal, engage the gearbox reverse gear and engage the winch.

4. The special system team should smoothly move the gun by hand over the floor beams. Smoothly lower the special system over the drop gate and the ramps by using the winch, the special system team supporting the trail.

5. After unloading the special system, close the drop gate.

When the carrier transports a truck or a high load over steep grades, ditches, etc., the cargo should be additionally fastened to the rings on the floor beams by means of four ropes fitted with turnbuckles and the carrier must be driven in the third gear.

E. Transporting Personnel and Miscellaneous Loads

To be transported, personnel should be seated in the carrier.

For better carrier stability the load should be evenly distributed over the entire platform so that the shutters are not obstructed. Do not place the loads on the engine hood, platform removable sections installed over the carrier units and the maintenance kit box. Place heavy loads only on the floor beams.

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ADJUSTMENT OF MECHANISMS AND CONTROL LINKAGE

A. Adjustment of Engine Clutch and Its Control Linkage

(Figs. 7, 8)

Adjustment should be made if the engine clutch pedal free travel measured on the level of the floor is less than 20 *mm* or in the event of the clutch slipping.

To adjust the engine clutch, proceed as follows:

1. Remove the hatch cover located under the engine clutch in the hull bottom.
2. Remove the engine clutch bottom hatch cover.
3. Fully depress the engine clutch pedal and fix it in this position.
4. Back off four clutch thrust plate stud nuts five complete turns.
5. Release the clutch pedal. This will make the adjusting shims free.
6. Take out one adjusting shim from under each strap.
7. Fully depress the clutch pedal and fix it in this position.
8. Turning the engine crankshaft, evenly draw up the nuts of the thrust plate studs.
9. Release the clutch pedal. The space between the support ring and the release sleeve should be 31.5 to 35 *mm*.

In the event the space between the support ring and the release sleeve meets the specifications, but the free travel of the engine clutch pedal is either under 25 *mm* or over 30 *mm*, adjust the engine clutch control linkage (Fig. 8), by using the following procedure:

1. Using adjusting screw *6* of the engine clutch pedal rear stop, position the engine clutch pedal so that its rod is vertical.
2. Adjust the length of rod 22 so that the horizontal distance "A" between the centre lines of shaft 20 and pin 19 is 60±1 *mm*.
3. Adjust the length of rod *8* so that the horizontal distance "B" between the centre lines of shaft *9* and pin *13* is 60±1 *mm*.
4. Adjust the length of rod *11* so that the free travel of the pedal is 25 to 30 *mm*.
5. Using adjusting screw *5* of the engine clutch pedal front stop, adjust the pedal free travel between 150 and 170 *mm*, so as to ensure complete disengagement of the engine clutch.
6. Check the adjustment of the engine clutch and its control linkage. To do this, start the engine, depress the engine clutch pedal, engage the second speed gear and start the vehicle by releasing the clutch pedal rapidly and smoothly.

The engine clutch pedal should readily come back into the initial position under the action of the pedal spring.

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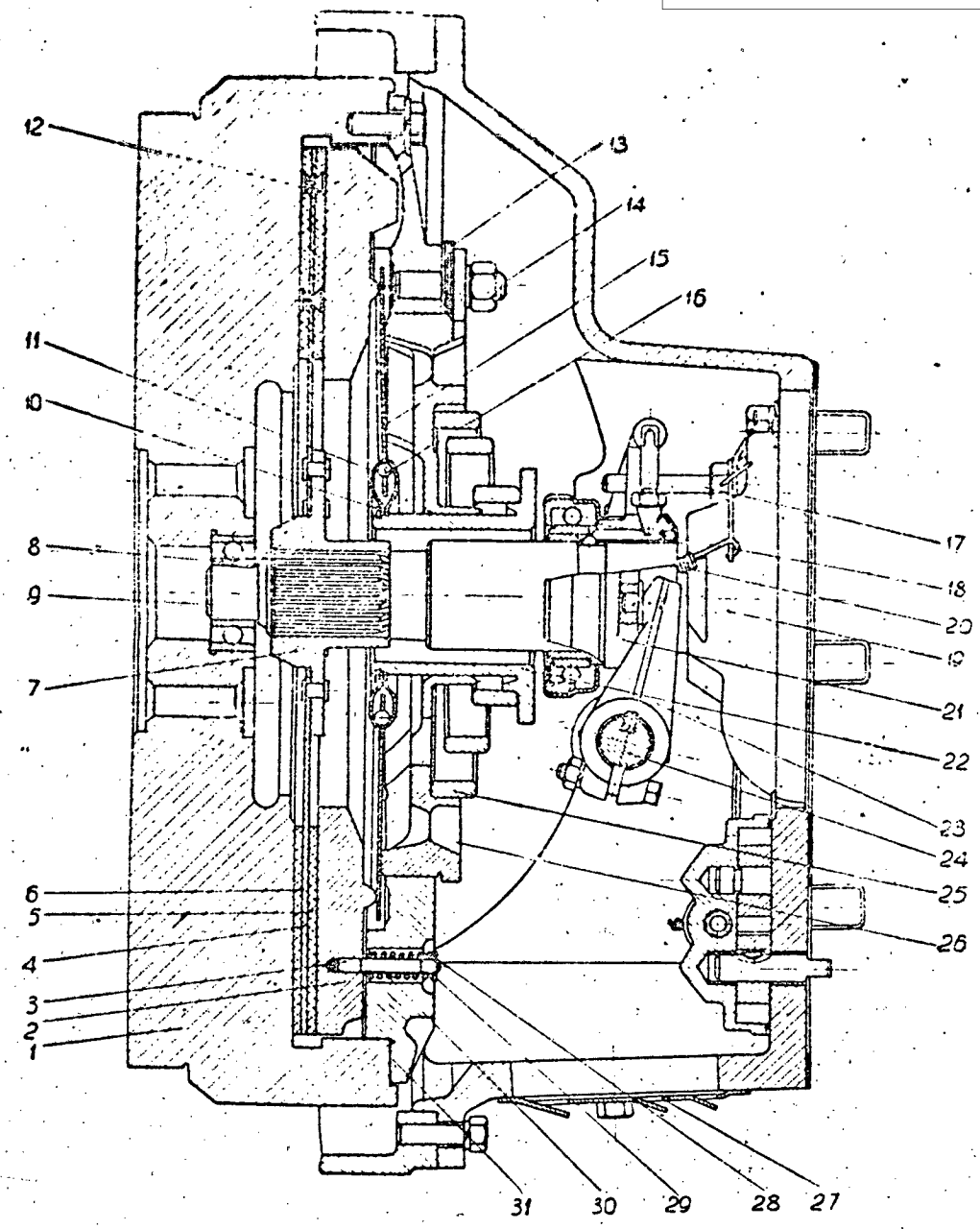

Fig. 7. Engine clutch:-

1—engine flywheel; *2*—pressure plate; *3*—pressure plate pin; *4*—driven disc; *5*—and *6*—friction linings; *7*—driven disc hub; *8*—bearing; *9*—gearbox drive shaft; *10*—retainer ring; *11*—ball cage; *12*—driven disc rivet; *13*—adjusting shims; *14*—nut; *15*—pressure lever; *16*—ball; *17*—release bearing sleeve guide pin; *18*—release bearing; *19*—gearbox drive shaft cover; *20*—release bearing sleeve retracting spring; *21*—release bearing sleeve; *22*—pressure lever sleeve; *23*—clutch release fork; *24*—clutch release fork shaft; *25*—pressure spring; *26*—clutch housing flange; *27*—inspection hatch cover; *28*—thrust washer; *29*—retracting spring thrust washer pin; *30*—retracting spring; *31*—clutch housing

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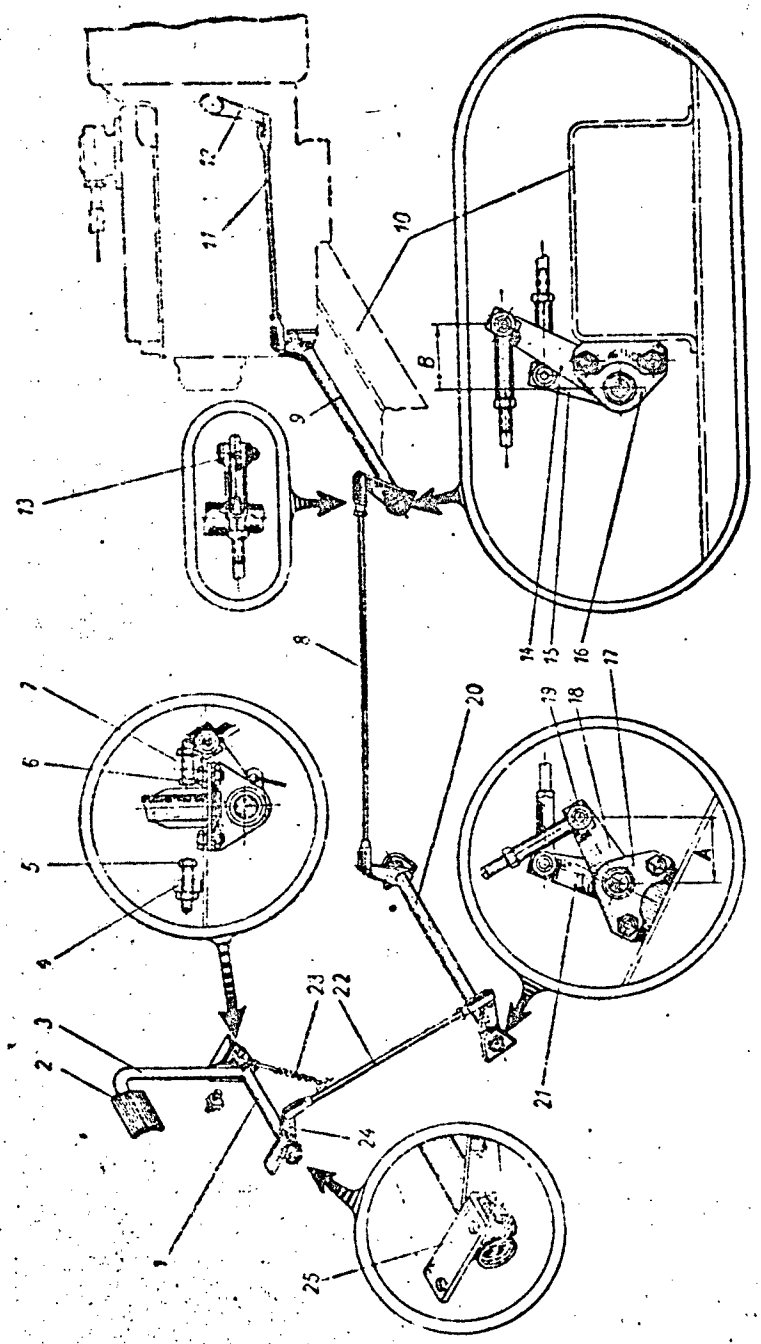

Fig. 8. Engine clutch control linkage:
1—clutch pedal shaft; *2*—clutch pedal; *3*—clutch pedalrod; *4*—pedal front stop bracket; *5*—pedal front stop adjusting screw; *6*—pedal rear stop adjusting screw; *7*—pedal rear stop bracket; *8*—rod; *9*—shaft; *10*—3rd torsion bar; *11*—rod; *12*—clutch release shaft lever; *13*—pin; *14*—shaft lever; *15*—shaft lever; *16*—shaft support; *17*—shaft support; *18*—shaft lever; *19*—pin; *20*—shaft; *21*—shaft lever; *22*—rod; *23*—pedal spring; *24*—pedal shaft lever; *25*—pedal shaft bracket

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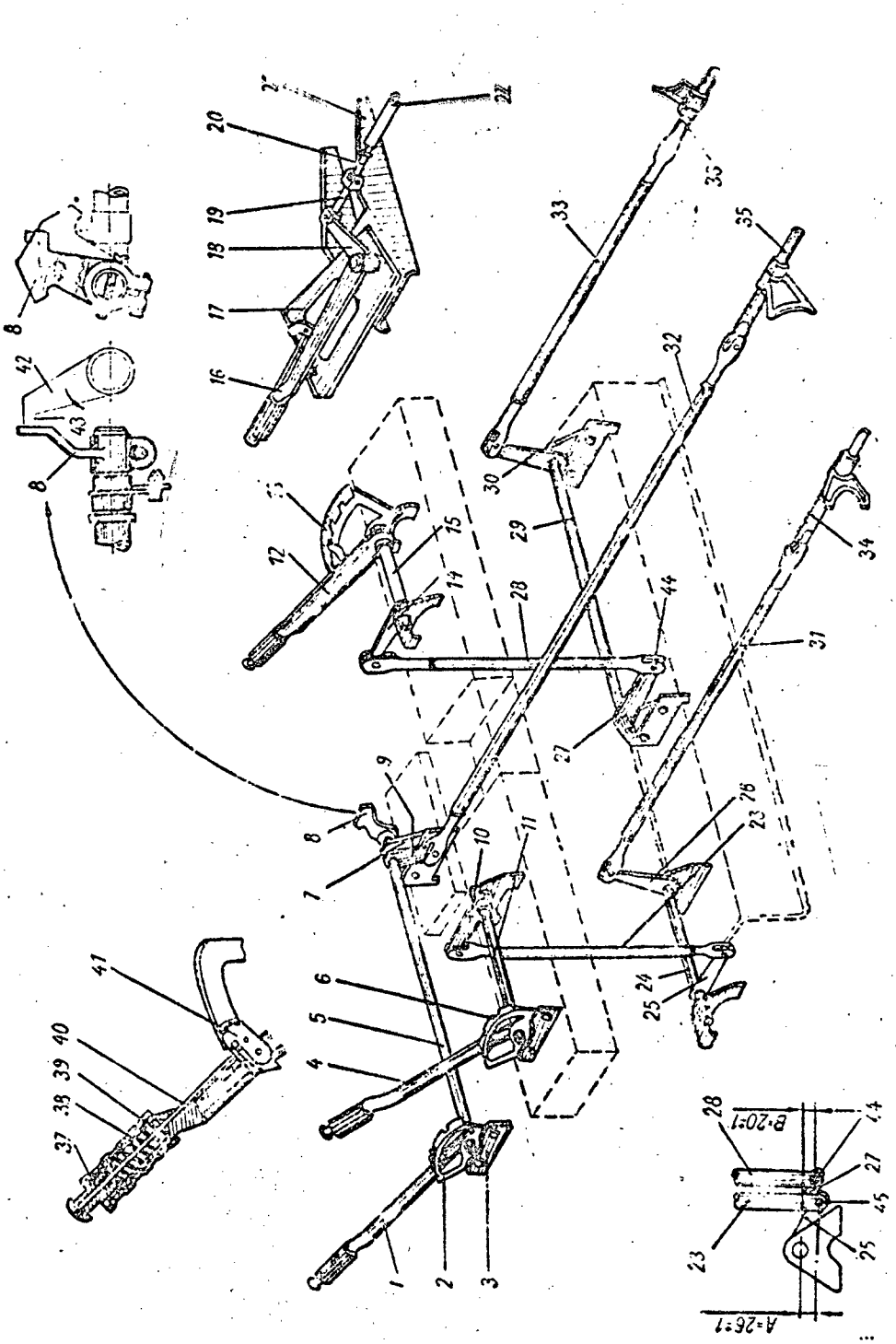

Fig. 9. Transfer case control linkage:

1—"screws and tracks" control lever; *2*—"screws and tracks" control lever support; *3*—bracket; *4*—port screw control lever; *5*—shaft; *6*—port screw control lever support; *7*—bracket; *8*—gear shift interlocking lever; *9*—lever; *10*—lever; *11*—port screw control lever shaft; *12*—starboard screw control lever; *13*—starboard screw control lever support; *14*—lever; *15*—starboard screw control lever shaft; *16*—winch control lever; *17*—winch control lever support; *18*—lever; *19*—clevis; *20*—adjusting screw; *21*—winch control lever bracket; *22*—winch control rod; *23*—rod; *24*—intermediate shaft, left-hand; *25*—lever; *26*—lever; *28*—rod; *29*—intermediate shaft, right-hand; *30*—lever; *31*—rod; *32*—rod; *33*—rod; *34*—port screw control rod; *35*—control rod; *36*—starboard screw control rod; *37*—control lever handle release button; *38*—control lever handle; *39*—control lever handle spring; *40*—control lever latch rod; *41*—control lever latch; *42*—screw interlocking lever; *43*—screw interlocking lever lug; *44*—pivot pin; *45*—pivot pin

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B. Adjustment of Transfer Case Control Linkage

(Fig. 9)

To adjust the transfer case control linkage, proceed as follows:

1. With control rod *35* moved backward as far as possible and lever *1* in the "screws" position, adjust the length of rod *32*.

2. Adjust the length of rod *23* so that when lever *4* is in the "forward" position the vertical distance "*A*" between the centre lines of shaft *24* and pivot pin *45* is 26+1 *mm*.

3. Adjust the length of rod *28* so that when lever *12* is in the "forward" position the vertical distance "*B*" between the centre lines of shaft *29* and pivot pin *44* is 20+1 *mm*.

4. After the adjustment of rods *23* and *28* move control rods *34* and *36* forward as far as possible, set the screw control levers into the "reverse" position and adjust the length of rods *31* and *33*.

5. Setting of adjusting screw *20* should be made with control rod 22 moved forward as far as possible and winch control lever *16* in the "on" position.

The correct adjustment of the control linkage should ensure that the transfer case gears and dog clutch are readily selected and properly meshed.

C. Adjustment of Axle Drive

(Fig. 10)

Normal operation of the axle drive depends on the correct gear backlash and taper bearing axial clearances.

Taper roller bearings *11* of driving shaft *4* are adjusted before installing the shaft in the axle drive housing by the use of the correct number of adjusting shims *7*.

The bearings are considered correctly adjusted of the shaft can be freely driven by hand and the shaft end play in the bearings is within 0.1 to 0.25 *mm*.

Adjustment of driven shaft taper roller bearings *15* is made through the use of adjusting shims *2* and *13*.

Adjustment of bevel gear meshing is made after the adjustment of the bearings by the use of adjusting shims *10* for bevel pinion *17* and shims *2* and *13* for bevel gear *18*. To adjust gear *18*, the adjusting shims should be taken out of set *2* and placed into set 13 or vice versa.

The bevel gear meshing is considered correct if the meshing backlash is 0.2 to 0.5 *mm* and the gear tooth contact marks are not less than 60 per cent of the tooth length.

Adjustment of the axle drive should be made in the service depot.

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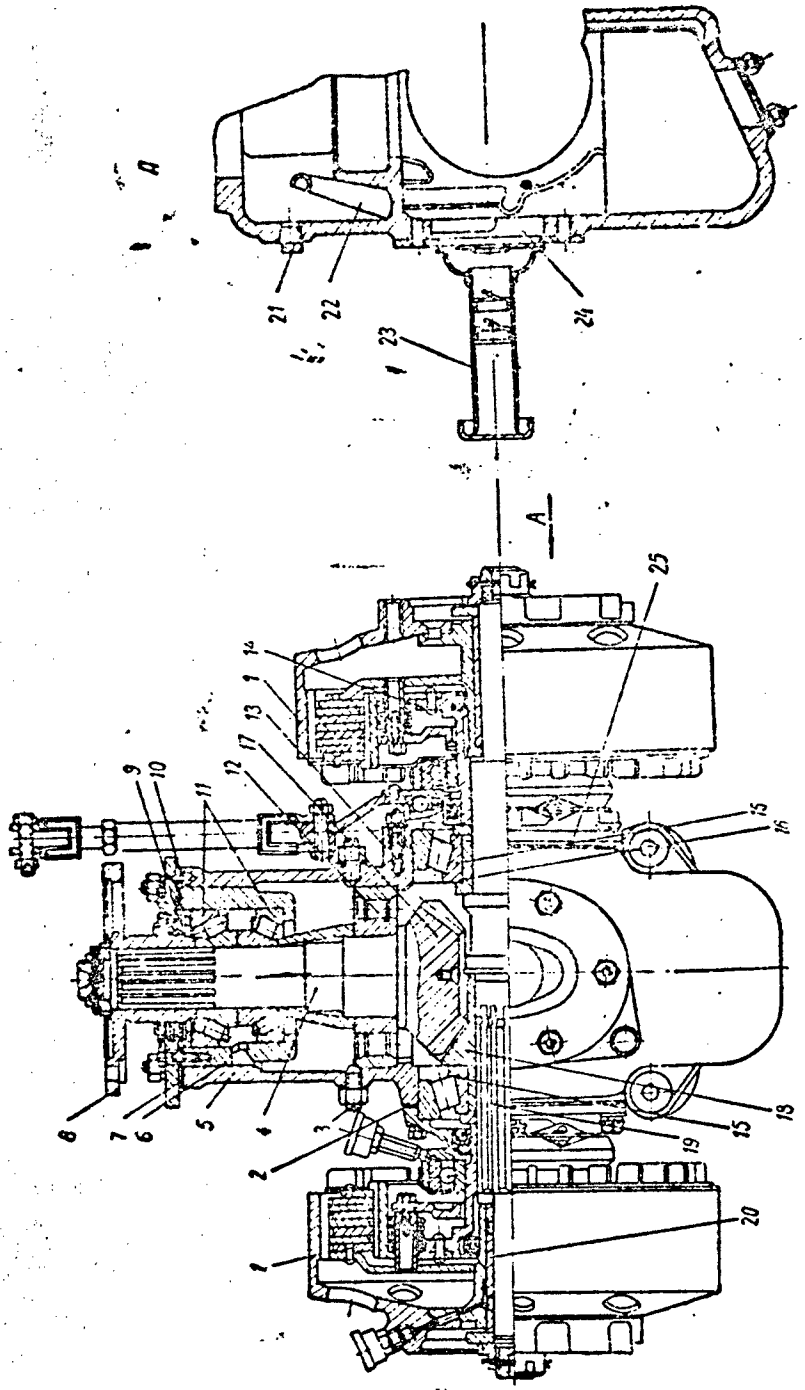

Fig. 10. Axle drive:
1—steering clutch driven drum; *2*—axle drive driven shaft adjusting shim set; *3*—stop screw; *4*—driving shaft; *5*—housing; *6*—sleeve; *7*—adjusting shims of driving shaft taper roller bearings; *8*—universal joint flange; *9*—sealing gland; *10*—driving gear adjusting shims; *11*—driving shaft taper roller bearings; *12*—roller bearing; *13*—driven shaft adjusting shim set; *14*—steering clutch driving drum hub; *15*—taper roller bearing; *16*—sleeve; *17*—bevel pinion; *18*—bevel gear; *19*—driven shaft; *20*—driven shaft sleeve; *21*—housing filler plug; *22*—lubricating trough for taper roller bearings; *23*—breather; *24*—hatch; *25*—bearing cover

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D. Adjustment of Steering Clutches Brakes, and Their Control Linkage

(Figs. 11, 12)

The adjustment should be made as follows:

1. By using adjustable stops *22* and *34* set steering clutch and brake control levers *9* and *21* into the position convenient for the driver.

2. Adjust the length of steering clutch control rods *13* and *24* so that the control lever free travel, as measured at the ends of the release buttons, is *25* to 30 *mm*.

3. Adjust the length of brake control rods *3* and *35* so that when the control levers rest against stops *22* and *34*, the ends of brake levers *2* and *36* are in the extreme forward position.

By using the nuts, adjust the travel of the control levers so that the brakes are fully applied by the control lever movement of 270 to 290 *mm*, as measured along the chord of the arc circumscribed by the ends of the control lever release buttons. Turn the nuts in half-turn steps so that they are heard to click.

4. By using the brake band adjusting screws adjust the clearance between the band shoes and the brake drum. With the steering clutch control levers moved all the way forward, the clearance should be from 0.75 to 2.25 *mm*.

5. Check whether the adjustment is correct by driving the carrier.

If the adjustment prescribed above proves ineffective due to heavy wear to the steering clutch discs, adjust the steering clutches by using the following procedure:

1. Disconnect the propeller shaft (Fig. 12) and rod *9* from the steering clutch.

2. Uncotter and unscrew nut *26* and remove the steering clutch together with movable release cup *11* from axle drive driven shaft *14*.

3. Remove cup *11* together with release bearing *17* from the steering clutch.

4. Reduce the number of adjusting shims *20* so that when the steering clutch is reassembled on the axle drive shaft and nut *26* is tightened up, the free travel of release lever *10* is 5 to 8 *mm*, as measured along the radius of the hole for the rod pin.

5. After the adjustment of the steering clutch has been made, adjust the control linkage of the steering clutches and brakes as instructed above.

E. Adjustment of Final Drive

(Fig. 13)

Adjustment of the final drive consists in adjusting of the taper roller bearings.

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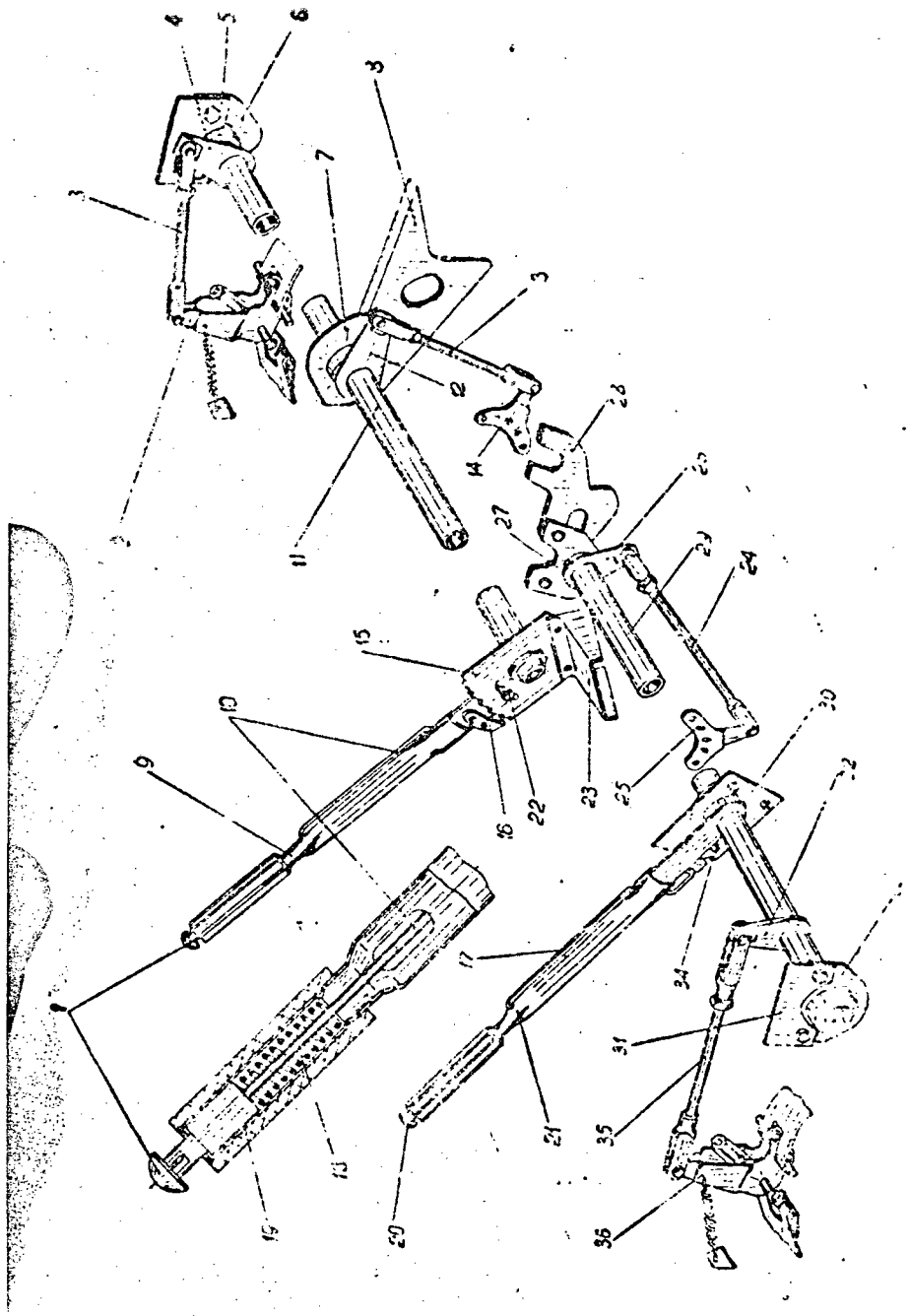

Fig. 11. Control linkage of steering clutches and brakes:
1—R.H. control lever release button; *2*—R.H. brake lever; *3*—R.H. brake control rod; *4*—lever; *5*—bracket; *6*—R.H. brake control shaft support; *7*—R.H. steering clutch control shaft support; *8*—bracket; *9*—R.H. steering clutch and brake control lever; *10*—R.H. control lever latch rod; *11*—R.H. shaft; *12*—lever; *13*—R.H. steering clutch control rod; *14*—R.H. steering clutch release lever; *15*—R.H. shaft support (with toothed sector); *16*—control lever latch; *17*—L.H. control lever latch rod; *18*—control lever latch spring; *19*—rubber hand grip; *20*—L.H. control lever release button; *21*—L.H. steering clutch and brake control lever; *22*—R.H. control lever stop; *23*—bracket; *24*—L.H. steering clutch control rod; *25*—L.H. steering clutch release lever; *26*—lever; *27*—L.H. shaft sup-

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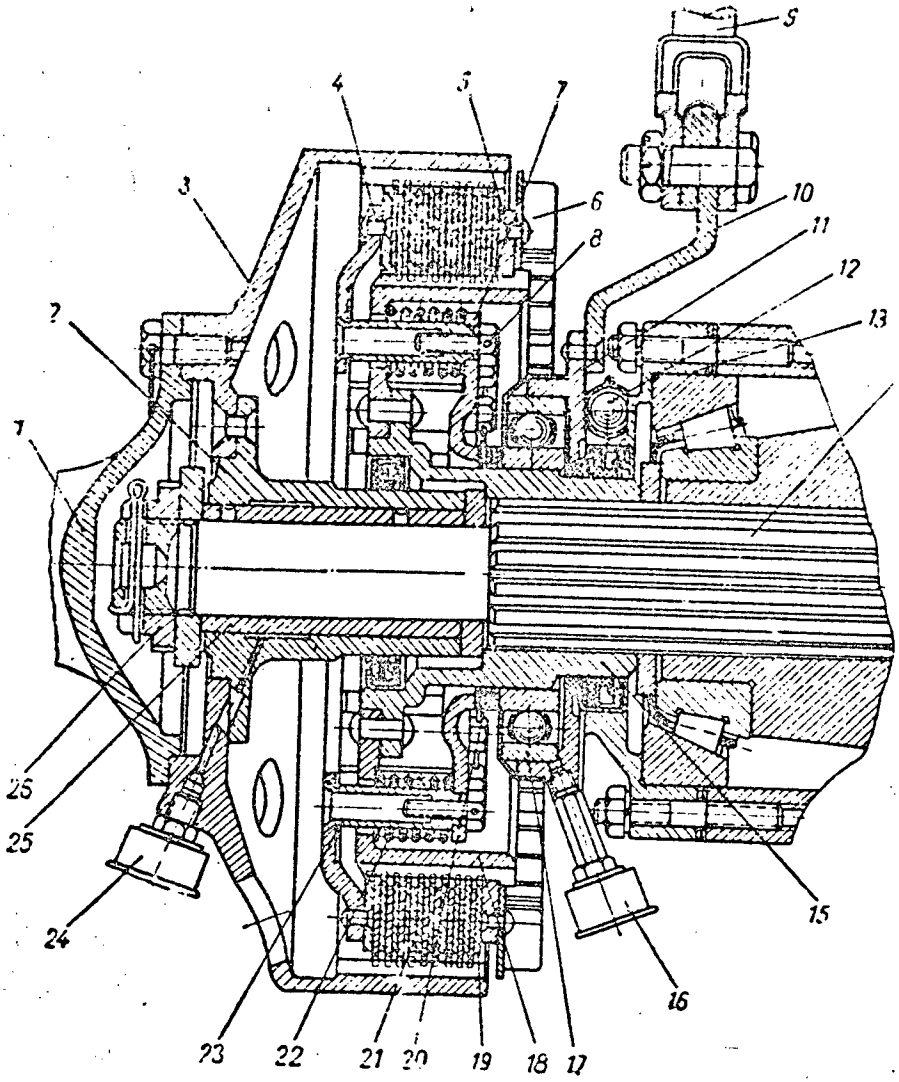

Fig. 12. Steering clutch:

1—steering clutch driven drum to final drive propeller shaft yoke flange; *2*—driven drum hub; *3*—driven drum; *4*—pressure plate; *5*—thrust disc; *6*—fan; *7*—release disc; *8*—guide pin to support disc bolt; *9*—control rod; *10*—release lever; *11*—movable release cup; *12*—release ball; *13*—stationary release cup; *14*—axle drive driven shaft; *15*—driving lubricator; *16*—release bearing lubricator; *17*—release bearing; *18*—driving drum; *19*—driving disc; *20*—adjusting shims; *21*—driven disc; *22*—pressure spring; *23*—guide pin; *24*—axle drive driven shaft lubricator; *25*—axle drive driven shaft sleeve; *26*—nut

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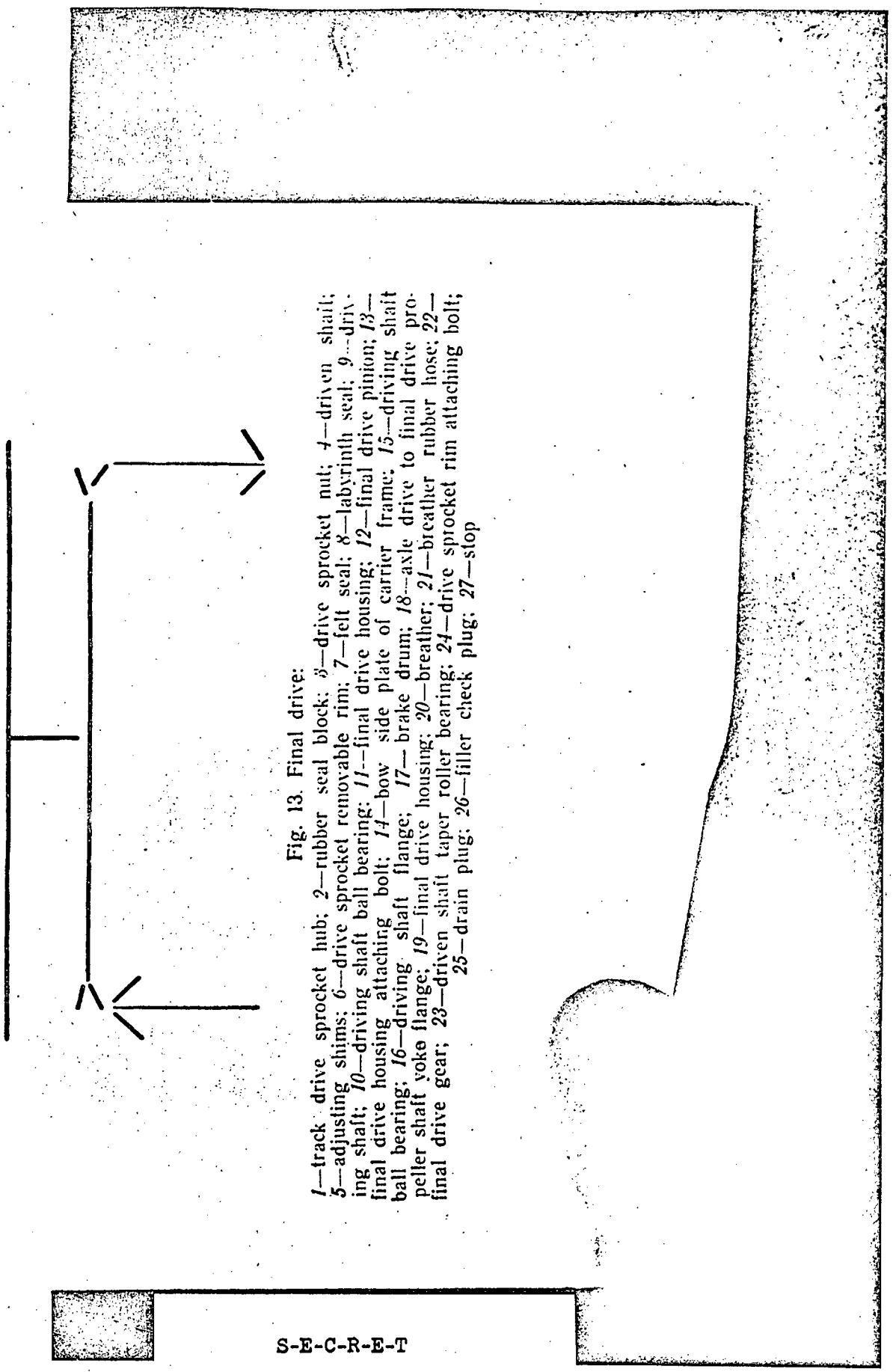

Fig. 13. Final drive:

1—track drive sprocket hub; *2*—rubber seal block; *3*—drive sprocket nut; *4*—driven shaft; *5*—adjusting shims; *6*—drive sprocket removable rim; *7*—felt seal; *8*—labyrinth seal; *9*—driving shaft; *10*—driving shaft ball bearing; *11*—final drive housing; *12*—final drive pinion; *13*—final drive housing attaching bolt; *14*—bow side plate of carrier frame; *15*—driving shaft ball bearing; *16*—driving shaft flange; *17*—brake drum; *18*—axle drive to final drive propeller shaft yoke flange; *19*—final drive housing; *20*—breather; *21*—breather rubber hose; *22*—final drive gear; *23*—driven shaft taper roller bearing; *24*—drive sprocket rim attaching bolt; *25*—drain plug; *26*—filler check plug; *27*—stop

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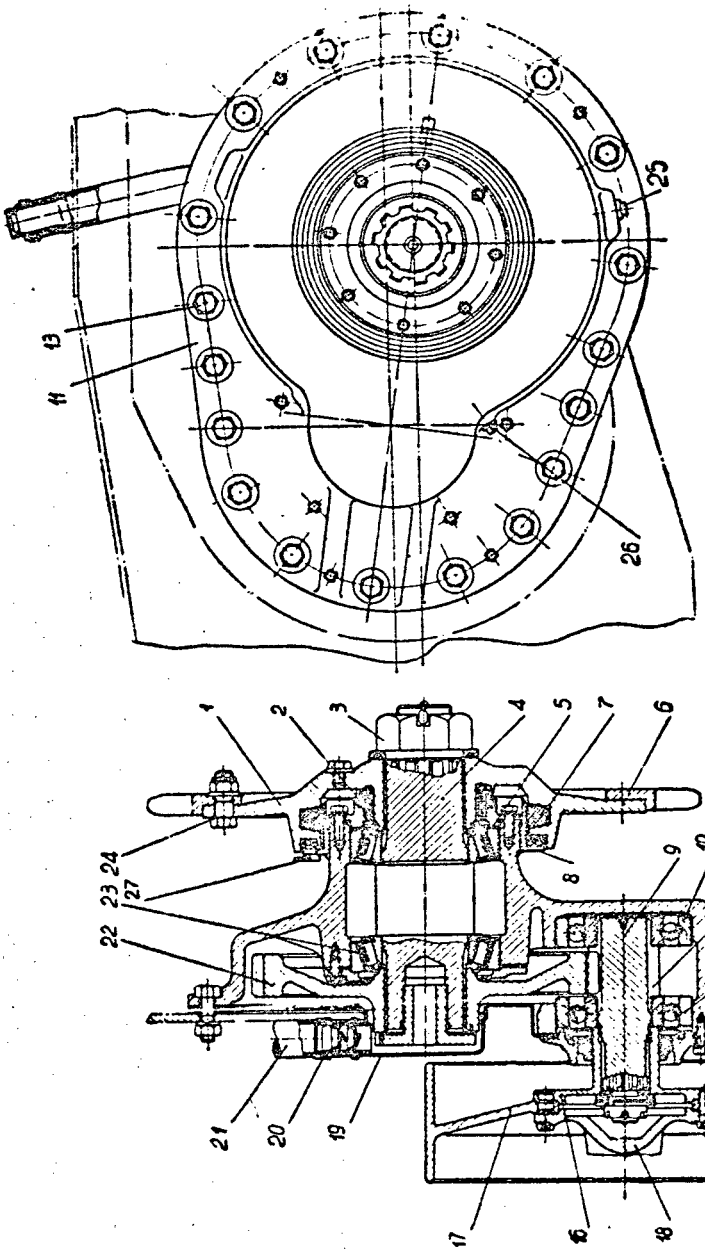

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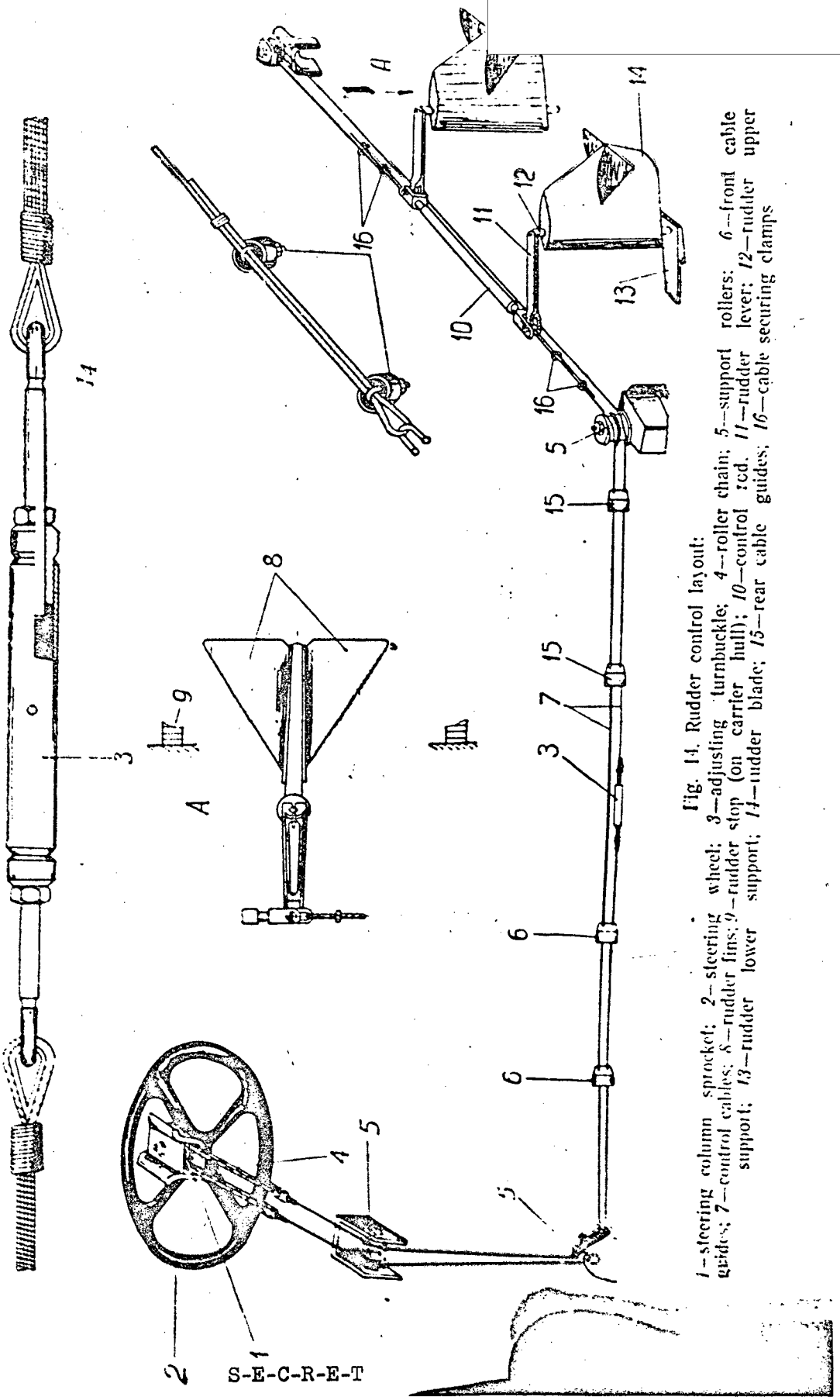

Fig. 14. Rudder control layout:
1—steering column sprocket; 2—steering wheel; 3—adjusting turnbuckle; 4—roller chain; 5—support rollers; 6—front cable guides; 7—control cables; 8—rudder fins; 9—rudder stop (on carrier hull); 10—control rod; 11—rudder lever; 12—rudder upper support; 13—rudder lower support; 14—rudder blade; 15—rear cable guides; 16—cable securing clamps

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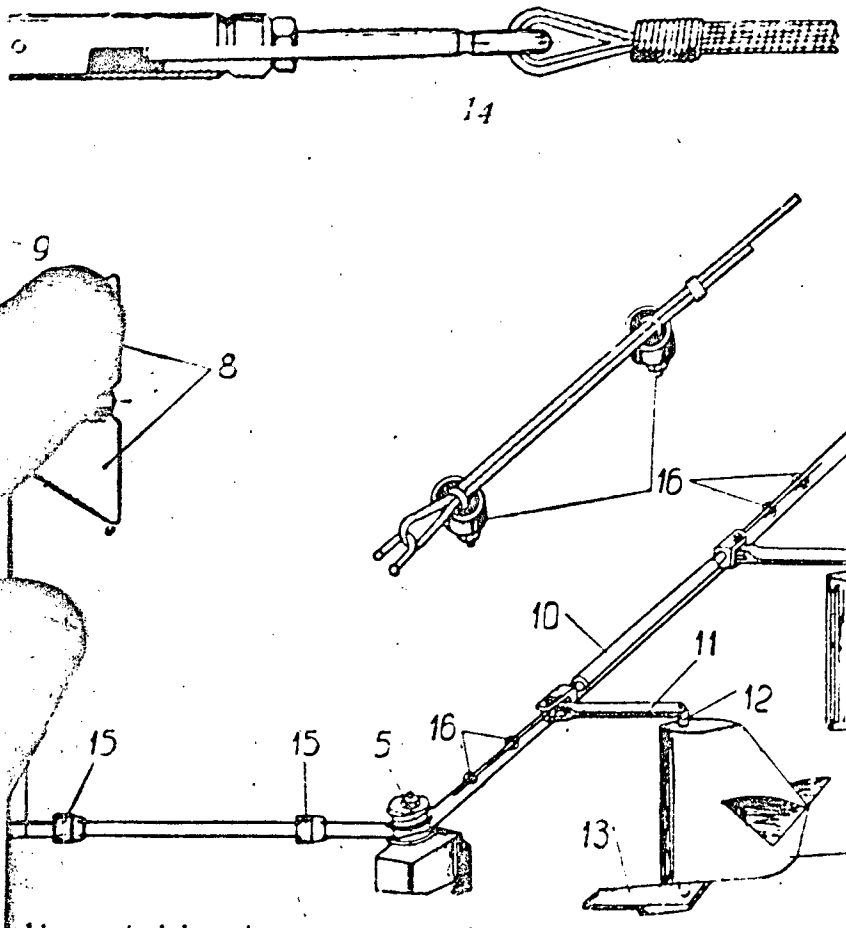
The end play of the final drive driven shaft should be wi 0.15 to 0.30 *mm*. The play below the specification will result overheating the bearings. In case of excessive play, the gear me ing becomes incorrect which may rapidly ruin the final drive.

To check the adjustment, determine the difference between measurements taken between the hub labyrinth and the wel



dder control layout:
turnbuckle; *4*—roller chain; *5*—support rollers; *6*—front cable rrier hull); *10*—control rod. *11*—rudder lever; *12*—rudder upper blade; *15*—rear cable guides; *16*—cable securing clamps

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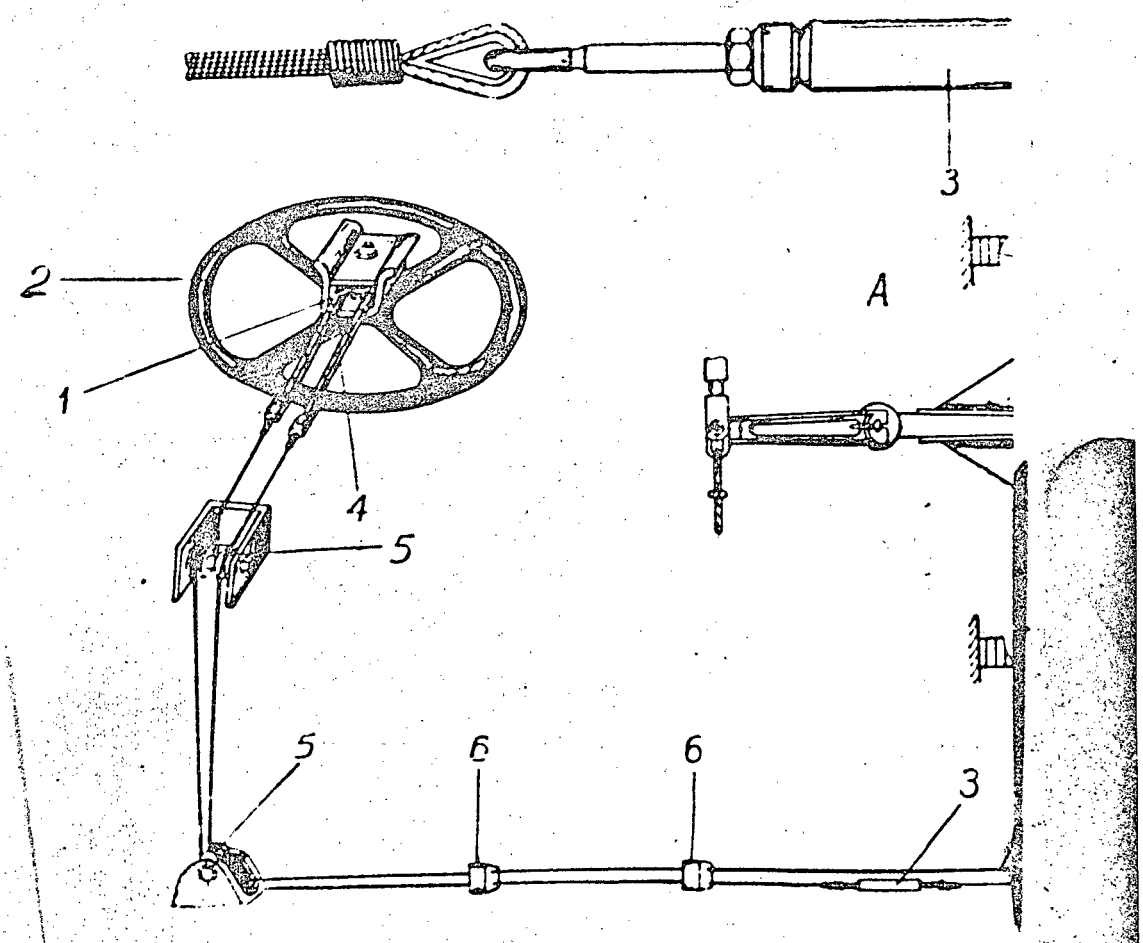

Fig. 14. R

1—steering column sprocket; *2*—steering wheel; *3*—adjusting guides; *7*—control cables; *8*—rudder fins; *9*—rudder stop (on ca support; *13*—rudder lower support; *14*—rudder

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The end play of the final drive driven shaft should be wi 0.15 to 0.30 *mm*. The play below the specification will result overheating the bearings. In case of excessive play, the gear me ing becomes incorrect which may rapidly ruin the final drive.

To check the adjustment, determine the difference between measurements taken between the hub labyrinth and the wel stop. One measurement should be taken with one-man effort (proximately 40 *kg* at each point) exerted to the drive sprocket shown in the sketch (plan view). The other measurement sho be taken with the same effort exerted in the opposite directi The measurement should be taken by using a feeler gauge inclu in the maintenance kit. If the difference between the two measu ments exceeds 0.3 *mm*, adjust the taper bearings. For the purp remove the drive sprocket and the bearing cover and add a sh of the appropriate thickness. The use of the shim should ensure difference between the above discribed measurements within 0 to 0.25 *mm*.

F. Adjustment of Rudder Control Linkage

(Fig. 14)

To make the adjustment, proceed as follows:

1. Install the cables 7 so that when the rudder blades are line with the vehicle fore-and-aft axis, there are the same numb of links of chain *4* on both sides of the steering wheel sprocket.

2. After installing the cables, adjust the cable tension by turni right-handed and left-handed turnbuckle *3*.

If adjusted correctly, the cables should not sag in excess 10 *mm* when subjected to a 2.5 *kg* load midway between guides.

After adjusting the cables the steering wheel should turn wh a 6.5 *kg* effort is applied to it.

Upon completion of the adjustment, the chain links on eith side of the steering wheel sprocket should not differ in number more than three, when the rudder blades are in line with t vehicle fore-and-aft axis.

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PROBABLE TROUBLES AND REMEDIES

ENGINE

The engine troubles, their causes and remedies are described in ЯМЗ Engine Technical Manual included in the set of technical papers accompanying every carrier.

POWER TRANSMISSION

A. Engine Clutch

To provide trouble-free operation of the engine clutch and its control linkage follow the instructions given below:

1. See that the free travel of the clutch pedal is correct. This must not be less than 20 *mm*.
2. Lubricate the engine clutch release bearing, sleeves, release fork shaft and control linkage pivot pins in compliance with the Lubrification Chart.
3. Periodically check to see that the engine clutch control linkage pivots are properly locked in place and the lock nuts are tightened up.

Engine Clutch and its Control Linkage Troubles and Remedies

Every operation necessitating disassembly of the engine clutch should be performed in the repair shop

Trouble	Cause	Remedy
Clutch slips. When engine is accelerated, carrier will not gain speed	1. Worn out driven disc linings	Adjust clutch
	2. Clutch pedal has no free movement	Adust pedal free movement
	3. Oily clutch discs 4. Weak pressure spring	Remove and disassemble clutch. Wash disc bearing surfaces. If gearbox front bearing seal or crankshaft seal is found leaky, find cause and correct fault
Clutch does not engage fully. Hard gear shift-	1. Excessive clutch pedal free movement	Adjust pedal free travel

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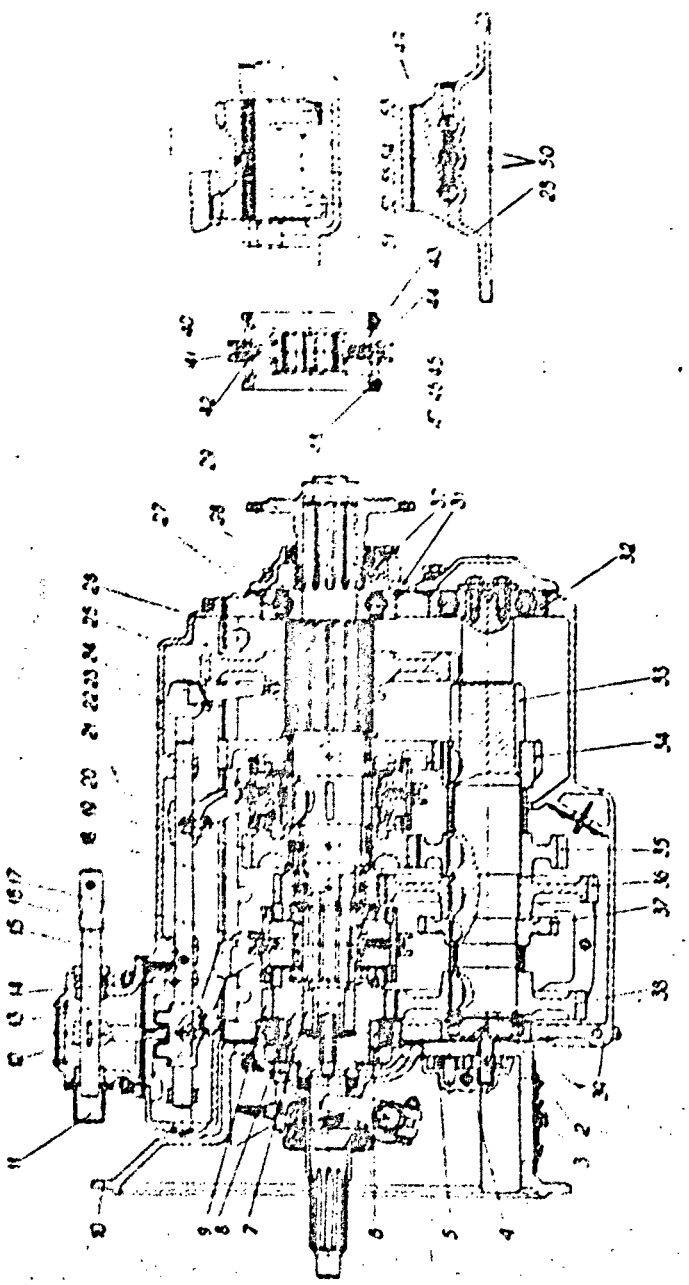

Fig. 15. Longitudinal section of gearbox:

1—roller bearing; *2*—countershaft; *3*—oil pump driving gear; *4*—pump body; *5*—oil pump driven gear; *6*—drive shaft ball bearings; *7*—main shaft roller bearing; *8*—drive shaft; *9*—drive shaft gear; *10*—engine clutch housing; *11*—shift rod lug; *12*—control rod lever; *13*—control rod; *14*—synchronizer cone; *15*—lock ball; *16*—fifth and fourth gear shift fork; *17*—fifth and fourth gear synchronizer; *18*—fifth speed driven gear; *19*—third speed driven gear; *20* third and second gear shift fork; *21*—third and second gear synchronizer; *22*—second speed driven gear; *23*—housing cover; *24*—first and reverse gear shift fork; *25*—first and reverse speed driven gear; *26*—main shaft; *27*—main shaft ball bearing; *28*—speedometer drive driving gear; *29*—flange; *30*—speedometer drive driven gear; *31*—main shaft bearing cover; *32* countershaft ball bearing; *33*—first and reverse speed driving gear; *34*—second speed driving gear; *35*—third speed driving gear; *36*—fifth speed driving gear; *37* power take-off gear; *38*—countershaft constant-mesh gear; *39*—gearbox housing; *40*—synchronizer sleeve ring; *41*—pin; *42*—synchronizer sleeve ring; *43*—spring; *44*—synchronizer lock ball; *45*—synchronizer sleeve; *46*—synchronizer outer sleeve; *47*—bronze ring; *48* rivet; *49*—side rod; *50*—lock balls; *51*—reverse speed shaft; *52*—reverse speed cluster gear; *53*—constant-mesh gear; *54*—reverse speed [illegible]

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Trouble	Cause	Remedy
ing accompanied with noise in gearbox	2. Distorted driven disc	Replace disc
Clutch pedal does not return into initial position	1. Weak or disconnected pedal retracting spring	Replace or attach spring
	2. Sticking control linkage shafts	Disconnect linkage, check shafts for operation and correct faults
With pedal fully depressed clutch will not engage	Disconnected control linkage	Connect linkage

B. Gearbox

(Fig. 15)

To provide trouble-free operation of the gearbox and its control linkage, follow the instructions given below:

1. Before each run of the carrier check the gearbox operation, with the carrier in motion, to see that the gear shifting is easy and noiseless.

2. Check gearbox oil level, change gearbox oil and lubricate all the gearbox control linkage pivots in compliance with the Lubrication Chart.

3. See that there is no abnormal gearbox heating. Pay special attention to local overheating. Clean dust, oil and dirt from the gearbox, see that there are no oil leaks.

4. Check that the screwed joints of the gearbox and its control linkage are properly drawn up and locked in place.

Gearbox and Its Control Linkage Troubles and Remedies

Every operation necessitating gearbox disambly should be performed in the repair shop

Trouble	Cause	Remedy
Noisy and hard gear shifting	1. Incomplete disengagement of engine clutch	See "Engine clutch troubles"
	2. Worn synchronizer sleeve	Replace synchronizers
Gearbox overheats (permissible heating temperature is 80—90°C)	1. Insufficient oil	Add oil
	2. Poor-quality oil	Replace oil
	3. Excessive oil	Drain excessive oil
Gearbox overheats at bearing location points	Worn out or destroyed bearings	Replace bearings

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Trouble	Cause	Remedy
Loud noise in gearbox, gearbox gearbox overheats	Worn or destroyed bearings, worn or broken gear teeth	Correct faults
Oil leaks at seals	1. Excessive oil 2. Worn or faulty seal	Drain excessive oil Replace seal
Gearbox spontaneously shifts out of gear	Worn shifter rod locks	Weld up worn recesses, replace weak lock springs
Gearbox lever does not lock in neutral	Broken or weak control lever spring in gear shift gate	Replace spring
Oil leaks at shift gate control rod seal	Control rod seal is loose	Tighten up seal. If seal cap abuts home, add packing
Gearbox control lever shifts hard or does not shift	1. Control rod seal is overtightened	Loosen seal
	2. Control rod sticks	Disassemble control rod, check either tail piece separately for operation and correct fault
	3. Shifter rods stick in gearbox housing cover	Correct fault
	4. Synchronizer sleeves or sliding gear sticks on splines	Correct fault

C. Transfer Case

(Fig. 16)

To provide throuble-free operation of the transfer case and its control linkage, follow the instructions given below:

1. Check that the transfer case gear shifting is secure, easy and noiseless and the control linkage is correctly adjusted.

2. Check the transfer case oil level, change the transfer case oil in due time, lubricate all the control linkage pivots.

3 See that there is no abnormal heating of the transfer case Pay special attetion to local overheating. Clean dust, oil and dirt from the transfer case, see that there are no oil leaks.

4. Periodically check to see that the transfer case is properly attached, the transfer case and control linkage screwed joints are properly drawn up and locked in place and the rubber cushions are in serviceable condition.

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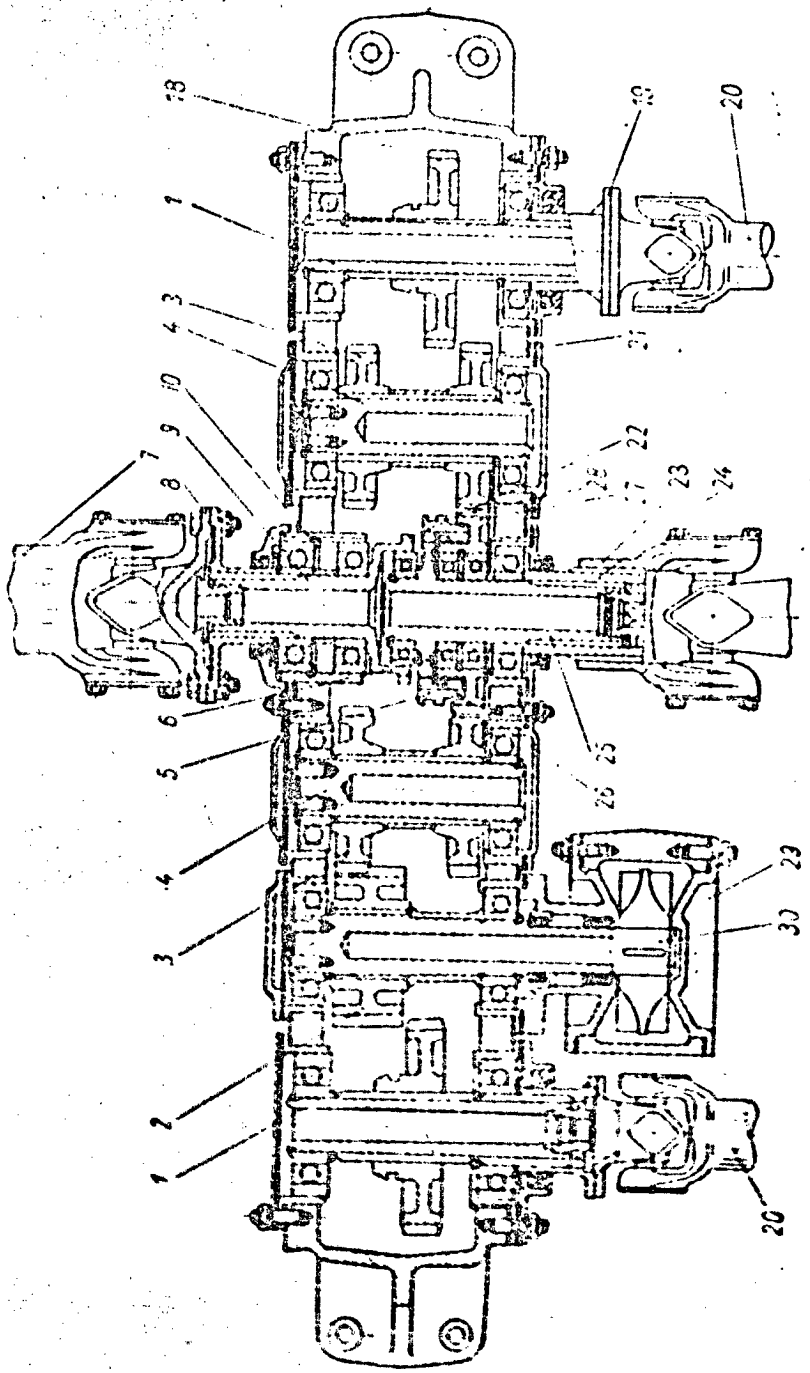
Transfer Case and Its Control Linkage Troubles and Remedies



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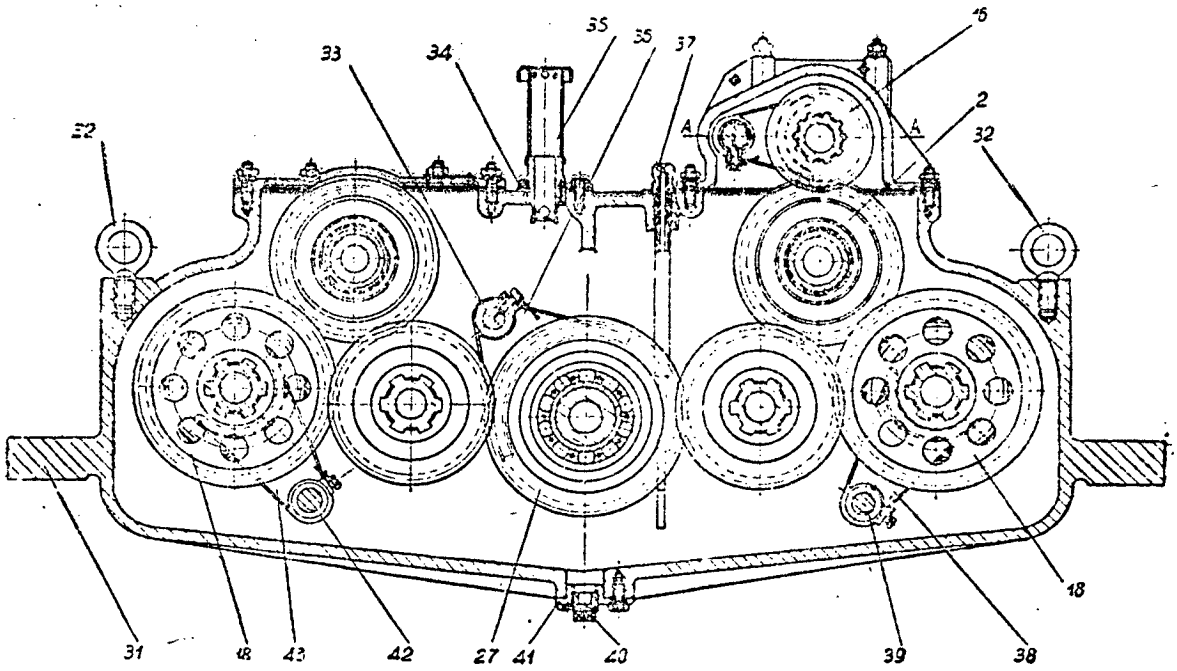

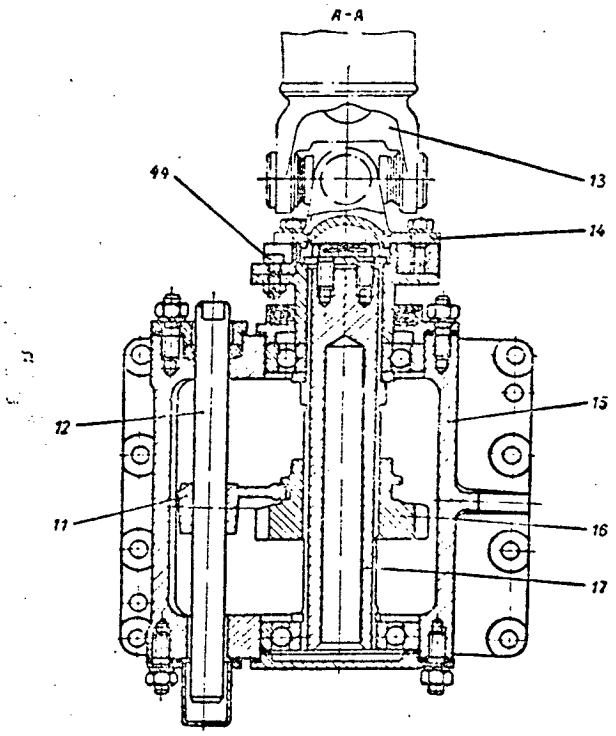

Fig. 16. Transfer case, section through shafts and cross section:

1—screw drive shaft; *2*—pump drive gear; *3*—countershaftfront gear; *4*—countershaft; *5*—sliding dog clutch; *6*—driving shaft toothed rim; *7*—propeller shaft from transfer case to axle drive; *8*—universal joint flange; *9*—driven shaft; *10*—driven shaft bearing sleeve; *11*—winchshifter fork; *12*—winch control rod; *13*—propeller shaft from transfer case to winch worm shaft; *14*—universaljoint flange; *15*—winch drive housing; *16*—winch drive shaft gear; *17*—winch drive shaft; *18*—screw drive shaft gear; *19*—universal joint flange; *20*—transfer case to screw shaft propeller shaft; *21*—countershaft rear gear; *22*—driven shaft toothed rim; *23*—propeller shaft yoke; *24*—driving shaft splined sleeve; *25*—driving shaft; *26*—transfer case driving gear small toothed rim; *27*—driving gear; *28*—driving gear large toothed rim; *29*—drainagepump; *30*—pump drive shaft; *31*—transfer case housing; *32*—lifting eye; *33*—screws and tracks control rod; *34*—upper adapter flange; *35*—breather; *36*—"screws and tracks" shift fork; *37*—dip stick; *38*—starboard screw shifter fork; *39*—starboard screw control rod; *40*—drain plug; *41*—drain neck; *42*—port screw control rod; *43*—port screw shift fork; *44*—safety bolt

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Transfer Case and Its Control Linkage Troubles and Remedies

Correcting trasfer case troubles should be made in the repair shop.

Trouble	Cause	Remedy
Noisy and hard gear shifting	Incomplete engine clutch disengagement	See "Engine clutch troubles"
Transfer case overheats (permissible temperature is 70—80°)	1. Excessive oil	Drain excessive oil
	2. Insufficient oil	Add oil
	3. Poor-quality oil	Replace oil
Transfer case overheats at bearing location	Worn out or destroyed bearing	Replace bearing
Oil leaks at seals	1. Excessive oil	Drain excessive oil
	2. Worn or faulty seal	Replace seal
Loud noise in transfer case, transfer case overheats	Worn out or destroyed bearings, worn out or destroyed gear teeth	Disassemble trasfer case and correct fault
Transfer case control lever does not shift or shifts hard	1. Sticking control linkage shafts	Disconnect linkage, check shafts for operation. Remove sticking shaft and correct fault
	2. Overtigtened transfer case control rod seal	Loosen seal
	3. Sticky transfer case control rod	Disassemble transfer case and correct fault
	4. Sticky sliding gear or dog clutch	Disassemble transfer case and correct fault
Oil leaks at control rod seal	Loose control rod seal	Tighten up seal
Transfer case control lever does not lock in required position	1. Jammed control lever release button	Disassemble lever and correct fault
Spontaneous gear shifting	2. Disconnected latch rod	Connect rod
Operation of control lever fails to make required gear shifting	Disconnected control linkage	Connect linkage
	Disconnected control linkage	Connect linkage

D. Axle Drive

See that there is no abnormal heating of the axle drive and pay special attention to local overheating. See that there are no oil leaks. Check that the axle drive is properly attached and the screwed joints are properly drawn up and locked in place. Clean dust, oil and dirt from the axle drive.

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Axle Drive Troubles and Remedies

All operation necessitating axle drive disassembly should be performed in the repair shop

Trouble	Cause	Remedy
Axle drive overheats (permissible temperature is 80—90°)	1. Excessive oil	Check oil level and drain excessive oil
	2. Insufficient oil	Check oil level and add oil
	3. Poor-quality oil	Check oil and change
Axle drive overheats at bearing location	1. Worn out or destroyed bearing	Replace bearing
	2. Incorrect bearing adjustment	Adjust bearing
Loud noise in axle drive, axle drive overheats	Worn out or broken gear teeth, destroyed or worn bearings. Improper gear meshing	Correct faults
Large oil leakage at seal	1. Worn or faulty seal	Replace seal
	2. Excessive oil	Drain excessive oil

E. Steering Clutches

To provide trouble-free operation of the steering clutches, brakes and their linkage, follow the instructions given below:

1. Engage and disengage the steering clutches smoothly. Do not allow the steering clutches to run incompletely engaged for a long time.

2. Before each run of the carrier check the steering clutches, brakes and their control linkage for secure operation by driving the carrier.

3. See that the free travel of the steering clutch and brake control levers is within 20 to 40 *mm*.

4. See that the movement of the control levers necessary to fully apply the brakes does not exceed 300 *mm*, as measured on the chord of the arc circumscribed by the ends of the control lever release buttons.

5. During the first maintenance inspection make adjustment to obtain even spaces between the brake drums and the brake band shoes.

Every 50 *km* of land operation, but not less than daily, lubricate steering clutch driven drum hubs, release bearing and release levers with constaline by the use of the lubricator fittings. Apply grease before the steering clutches cool down. The use of solid oil is not permissible. Lubricate the control linkage pivots as instructed in the Lubrication Chart.

6. See that there is no abnormal heating of the steering clutches and brakes. Clean the clutches of dust, oil and dirt.

7. See that the control linkage pivot pins are securely locked in place and the lock nuts are tightened up.

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Troubles and Remedies of Steering Clutches, Brakes and Control Linkage

All operations necessitating steering clutches disassembly should be performed in the repair shop.

Trouble	Cause	Remedy
With control lever pulled all way backward, the brake fails to operate	1. Excessive clearance between brake band and drum	Adjust clearance
	2. Steering clutch driven drum hub jams due to lack of lubricant	Feed lubricant. If jamming still exists, disassemble steering clutch, clean or replace hub
Steering clutch slips when carrier runs in low gear, resulting in carrier turning and steering clutch heating	1. Control lever has no free travel due to wear of clutch discs	Check and adjust
	2. Oily clutch discs	Remove and disassemble steering clutch. Wash discs in gasoline. Replace worn discs if scored. Stop oil leaks
Steering clutch seal fails to retain lubricant	1. Poor-quality lubricant	Check and change lubricant
Control lever does not return into initial position	2. Worn or faulty seal	Replace seal
	1. Weak or disconnected brake lever retracting spring	Replace or connect spring
	2. Sticky control linkage shaft	Disconnect linkage and check shaft for operation. Remove sticky shaft and correct fault

F. Final Drives

To provide trouble-free operation of the final drives follow the instructions given below:

1. Refill and change oil in the final drives in compliance with the Lubrication Chart.

2. When performing maintenance operations prescribed under "Service after Prolonged Water Operation" check whether water has got into the final drives. For the purpose allow the vehicle to be at rest 5 to 8 minutes and then remove the drain plugs. If water is found, drain it until oil appears. At the earliest scheduled maintenance correct the faults and change oil.

3. See that there is no abnormal heating of the final drives. Pay special attention to local overheating. Clean the final drives of dust, oil and dirt. See that there is no oil leakage.

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4. Periodically check that the final drives are properly attached. See that the screwed joints are securely drawn up and locked in place.

Final Drive Troubles and Remedies

All operations necessitating final drive disassembly should be performed in the repair shop.

Trouble	Cause	Remedy
Final drive overheats (permissible temperature 80 to 90°)	1. Excessive oil 2. Insufficient oil 3. Poor-quality oil	Drain excessive oil Add oil Change oil
Final drive overheats at bearing location	Worn out or destroyed bearing	Replace bearing
Loud noise in final drive, final drive overheats	Excessive end play of tapered bearings, worn or broken gear teeth, worn or destroyed bearings	Correct fault
Oil leaks at seals	1. Worn or faulty seal 2. Excessive oil 3. Clogged breather	Replace seal Drain excessive oil Clean breather
Water penetrates into final drive	1. Worn or faulty outer rubber seal 2. Hub was insufficiently packed with grease before carrier entered water	Replace seal

G. Propeller Shafts

Lubricate the propeller shafts in compliance with the Lubrication Chart, periodically check the screwed connections are tightened up and locked in place, clean the drives of dirt, dust and oil.

TRACK ASSEMBLY

A. Track Mover

To provide trouble-free operation of the track assembly, follow the instructions given below:

1. Before each run of the carrier, check the track tension and tighten the tracks if necessary. To drive in mud, snow, sand and irregular terrain, slacken the tracks.

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2. In case the track length increases due to wear on track link holes and pins, reduce the number of track links.

The number of the track links is permitted to be reduced to 115, where upon the tracks and the track drive sprocket rims should be replaced with new ones.

3. Periodically inspect the track link pins. If dislodged pins are found, drive them home and flatten the pin ends.

4. If cracks have developed on the lugs or centre portions of the track links, replace the links at the earliest opportunity. In the event of cracks on double-hole lugs of the track links, replace the links immediately.

5. See that plugs are present on the road wheels, idler wheels and suspension brackets.

6. See that the road wheel hub cap and stops are properly attached.

7. During Maintenance No. 1 check the road wheel play. If necessary, tighten the road wheel shaft nuts.

8. Periodically remove dirt from the road wheels, idler wheels and tracks.

9. Lubricate all parts of the track assembly in compliance with the Lubrication Chart.

Track Assembly Troubles and Remedies

Trouble	Cause	Remedy
When in motion, carrier tends to move aside	Different tension of tracks	
Road wheel and idler wheel hubs overheat (permissible temperature 50—60°C)	1. No lubricant in hub	Add lubricant
	2. Destroyed or worn bearings	Replace bearings

B. Water Mover

(Fig. 17)

To provide for proper operation of the water mover, follow the instructions given below:

1. Perform lubrication in compliance with the Lubrication Chart.

2. During the maintenance procedure prescribed under "Service after Prolonged Water Operation" and the Maintenance Service No. 1, check the condition of the packing glands, rudders and screw shaft. If necessary, tighten the rudder and screw packing glands.

3. See that there is no abnormal heating of the screw shafts rear bearing sleeves.

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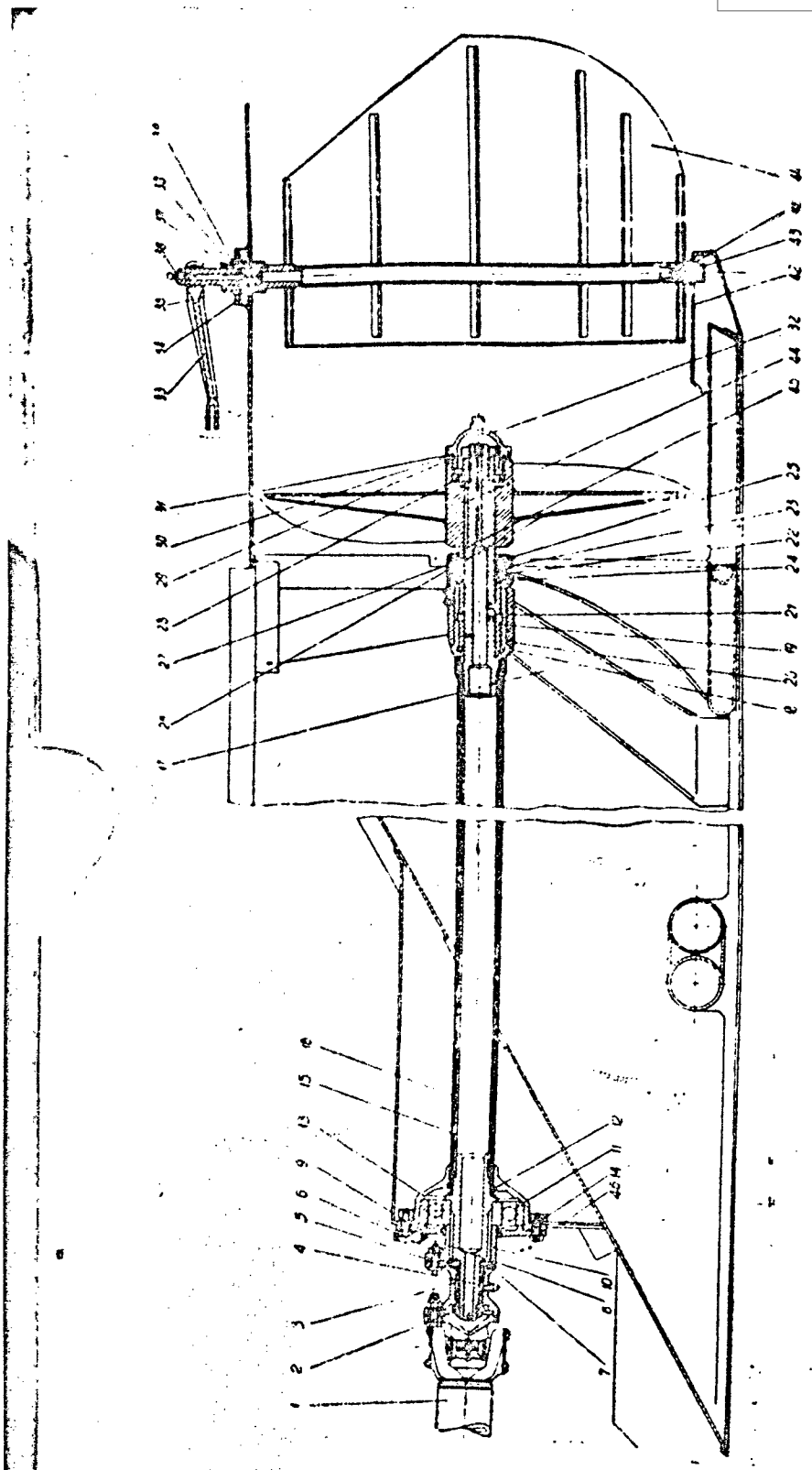

Fig. 17. Screw and rudder:
1—transfer case to screw shaft propeller shaft; *2*—screw shaft nut; *3*—safety sleeve; *4*—lubricator fitting; *5*—bronze sleeve; *6*—case iron safety bolts; *7*—thrust ring; *8*—plug; *9*—bearing housing cover; *10*—nub; *11*—ball bearing; *12*—screw shaft front bearing sealing glands; *13*—ball bearing housing; *14*—bolt; *15*—screw shaft; *16*—screw shaft casing; *17*—support; *18*—sleeve housing; *19*—bronze sleeve; *20*—adjusting ring; *21*—support sleeve; *22*—screw shaft rear bearing sealing glands; *23*—sealing gland ring; *24*—rear bearing nut; *25*—sealing gland nut; *26*—screw; *27*—felt rings; *28*—screw nut; *29*—screw lock nut; *30*—lock washer; *31*—fibre gasket; *32*—screw cap; *33*—rudder lever; *34*—rudder upper support gland housing; *35*—rudder upper support gland packing; *36*—lubricator fitting; *37*—flange; *38*—rudder upper support sleeve; *39*—nut; *40*—rudder blade; *41*—rudder lower support sleeve; *42*—rudder lower support; *43*—rudder blade spindle; *44*—screw key; *45*—retainer; *46*—tunnel lip flange

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4. Check that the rudder steering wheel turns readily and smoothly.

5. During daily maintenance, check that the parts and units of the screws and rudders are properly attached.

Water Mover Troubles and Remedies

Touble	Cause	Remedy
Screw drive protective sleeve bolts are shorn (with propeller shaft running, screw does not rotate)	Excessive load on screw shaft. Screw is jammed by foreign objects in screw tunnel	Eliminate source of trouble. Replace bolts
Screw shaft front bearing overheats (permissible temperature 50—60°C)	1. No lubricant	Lubricate
Water or lubricant leaks through front bearing gland	Water inside bearing	Tighten screw shaft rear bearing gland. Check screw shaft casing for damage. Correct faults. Lubricate screw shaft bearings
Screw shaft rear bearing sleeve overheats	1. Overtightened screw shaft front bearing gland	Loosen gland
	2. No lubricant	Lubricate
Steering wheel turns hard	1. Dirt and grit on rudder drive supports and joints Foreign subjects hampering control cables	Eliminate cause of trouble. Lubricate all rubbing parts
	2. Overtightened rudder upper support glands	Loosen glands
	3. Too taut cables	Loosen cables
Water penetrates through rudder upper support	Loose upper support gland	Tighten gland

SPECIAL EQUIPMENT

A. Drainage System

(Fig. 18)

Inspect and clean the suction intake mesh screens and the priming pipe line mesh screen in due time. Inspect pipe line connections to see they are tight and replace the mesh screens if found broken.

The above operations should be performed in getting the carrier ready for water running.

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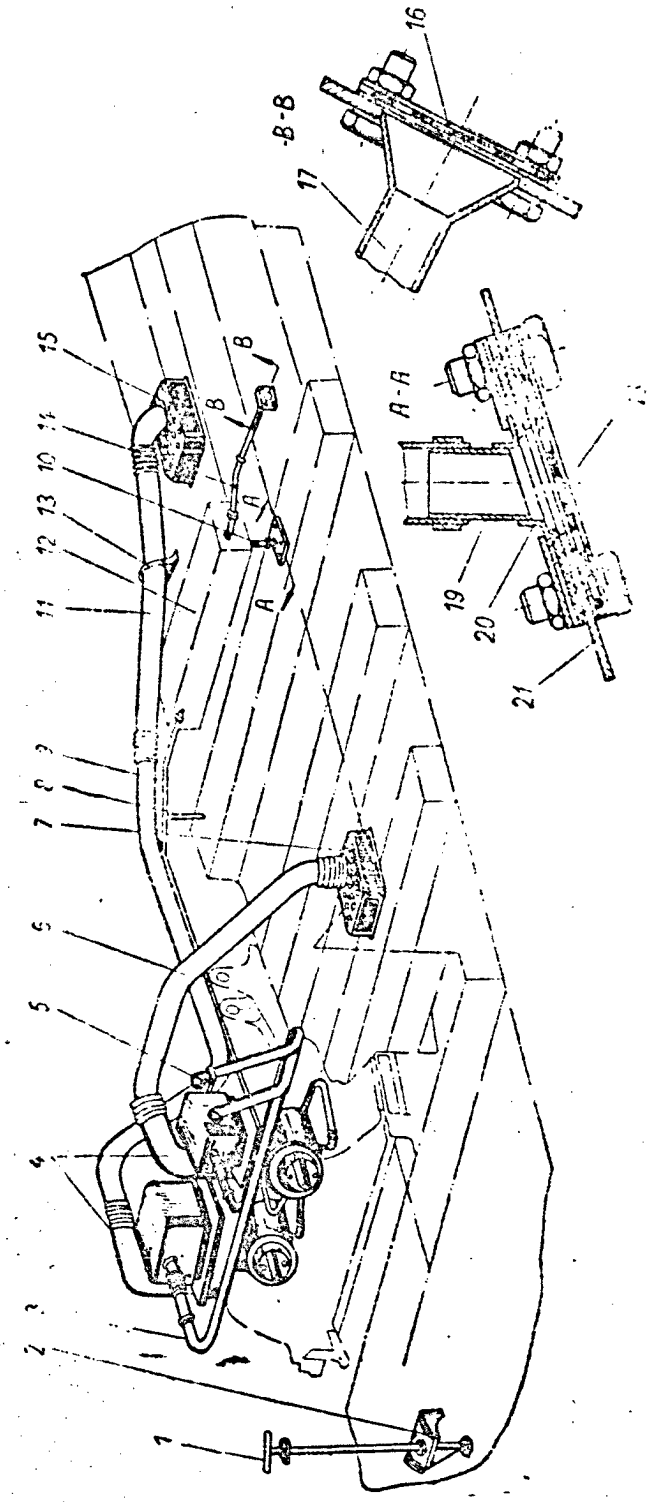

Fig. 18. Drainage system:
1—drain valve; *2*—drain valve bracket; *3*—outlet pipe line; *4*—drainage pumps; *5*—outlet pipe line; *6*—suction pipe line; *7*—front suction intake; *8*—bracket; *9*—priming pipe line; *10*—priming pipe line; *11*—suction pipe line; *12*—heat exchanger; *13*—bracket; *14*—priming pipe line; *15*—rear suction intake; *16*—priming mesh; *17*—priming neck; *18*—priming mesh; *19*—drain connection; *20*—pressure plate; *21*—sealing gasket

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Drainage System Troubles and Remedies

Trouble	Cause	Remedy
Low output of both pumps, with sufficient water in vehicle	1. Priming line does not supply water to pumps (priming line mesh screens are clogged)	Clean screens
	2. Both suction intake screens are clogged	Clean screens
	3. Air enters both suction lines	Check rubber canvas hoses on suction lines and tighten clamps
Low output of one pump, with sufficient water in vehicle	1. Suction intake screen is clogged	Clean screen
	2. Air enters suction line	Check suction line rubber canvas hoses

B. Anchor

To hold the carrier in place when afloat, an anchor is provided. It consists of the anchor shaft, arms, stock and shackle. By means of the stock the anchor arms are attached to the lower end of the anchor shaft, which upper end carries the shackle. The anchor is stowed in the right-hand recess of the driver's compartment. To anchor the carrier, remove the anchor from its stow position, install the stock and attach the anchor shackle to the winch cable.

To attach the anchor to the winch cable, screw out the bolt holding the shackle to the anchor, put the shackle into the cable thimble and bolt the shackle with the thimble to the anchor.

To drop the anchor, push it down from the carrier bow, with the winch drum disengaged from the sliding clutch. To weigh the anchor, use the winch.

C. Winch

(Fig. 19)

The winch is provided for loading and unloading wheeled units, weighing anchor and self-recovering.

Winch Main Parts:

Reduction gear
Drum
Drum engagement mechanism
Cross member
Brake
Propeller shaft
Safety arrangement
Cable with hook

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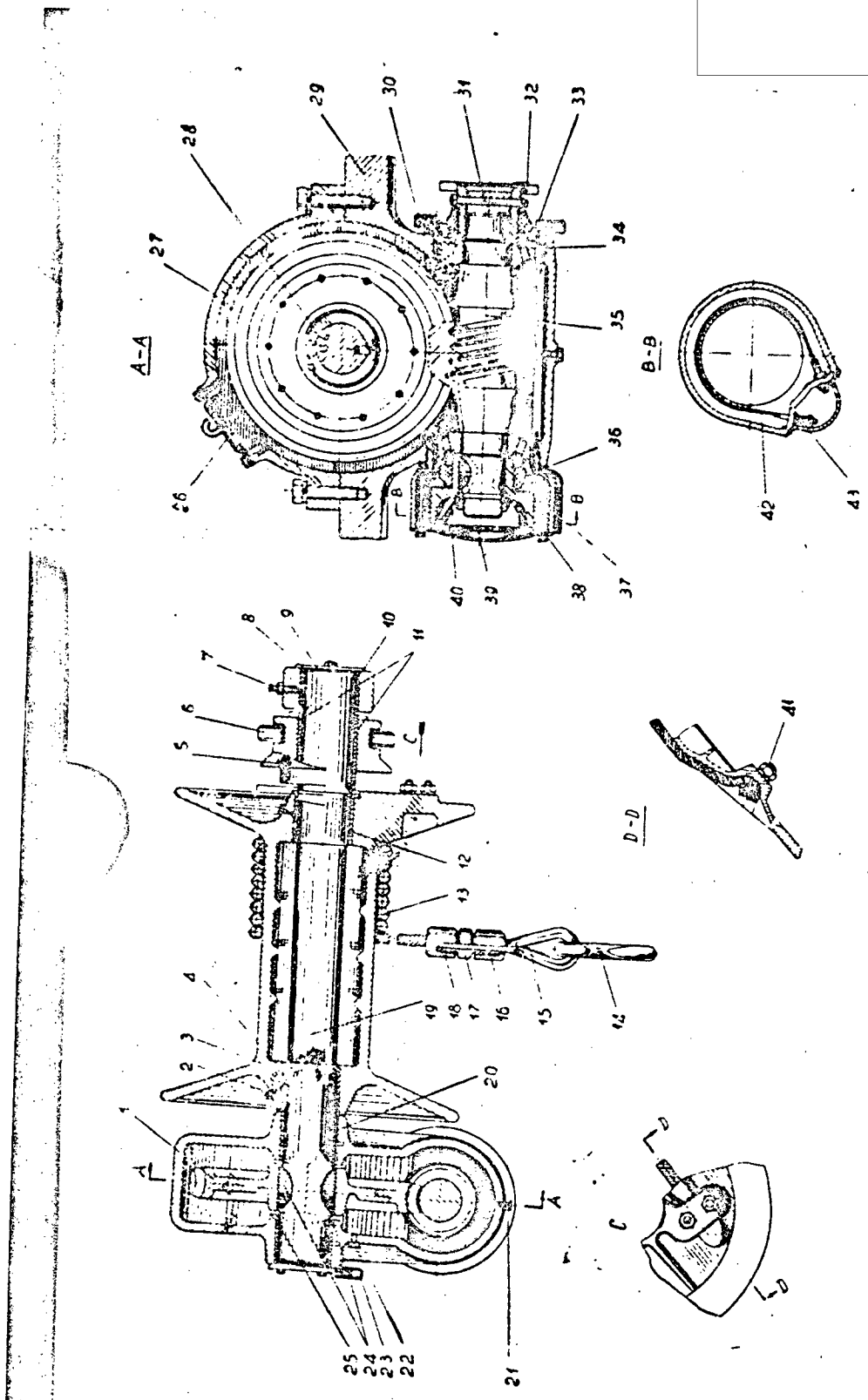

Fig. 19. Winch:

1—worm wheel rim; *2*—lubricator fitting; *3*—drum; *4*—sleeve; *5*—sliding sleeve; *6*—shifter fork; *7*—lubricator fitting; *8*—washer; *9*—adjusting shims; *10*—sleeve; *11*—key; *12*—sleeve; *13*—cable; *14*—hook; *15*—thimble; *16*—coupling nut; *17*—coupling; *18*—coupling nut; *19*—shaft; *20*—sleeve; *21*—drain plug; *22*—check plug; *23*—oil sump; *24*—woodruff key; *25*—sleeve; *26*—cover with breather; *27*—housing cover; *28*—pin; *29*—reduction gear housing; *30*—packing ring; *31*—pin; *32*—flange; *33*—bearing cover; *34*—taper roller bearing; *35*—worm; *36*—adjusting shims; *37*—brake housing; *38*—brake drum; *39*—Woodruff key; *40*—reduction gear brake cover; *41*—clamp; *42*—brake band; *43*—spring

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Winch Specifications:

Maximum permissible load, *kg*	4,500
Cable length, *m*	50
Cable diameter, *mm*	13

Operating Winch

Operate the winch at an engine speed of not more than 1,500 *r.p.m.* Systematically clean the winch of dust, oil and dirt, check that the bolts and nuts are tightened up and locked in place, see that there is no abnormal heating and oil leaks and ensure that the cable is correctly wound on the drum.

Special attention should be paid to see that the nuts of the clamp holding the winch cable to the drum as well as the cable thimble nuts are properly tightened up. Lubricate the winch in due time.

To prevent the possibility of damage or an accident due to overloading, the end of the winch drive shaft is fitted with a safety arrangement based on the use of a safety bolt made to close limits.

Note. The safety bolt should be made from grade 20 steel and must have a shearing strength of 45 to 53 *kg/sq mm.* The bolt recess diameter should be 4.7 to 0.1 *mm.*

To prevent the load from falling in the event the winch has been disengaged or the bolt has been shorn, the winch reduction gear is fitted with a brake drum and brake band.

Self-Recovery

(Fig. 20)

Use the winch to assist the carrier in going in the event the vehicle has insufficient ground grip or has slightly deepened in the ground (but does not rest on the hull bottom).

Proceed as follows:

At a distance of not more than 25 *m* from the carrier find or install a subject to serve as an anchor. Attach the snatch block included in the maintenance kit to the anchor. Reeve the winch cable over the snatch block and attach the cable end to the carrier. Next engage the winch and wind the cable on the winch drum.

To assist the carrier by using a log, proceed as follows:

Attach the log to the front inclined stretches of the tracks with cables included in the maintenance kit and drive forward until the log is at the vehicle rear. Detach the log and, if necessary, repeat the procedure.

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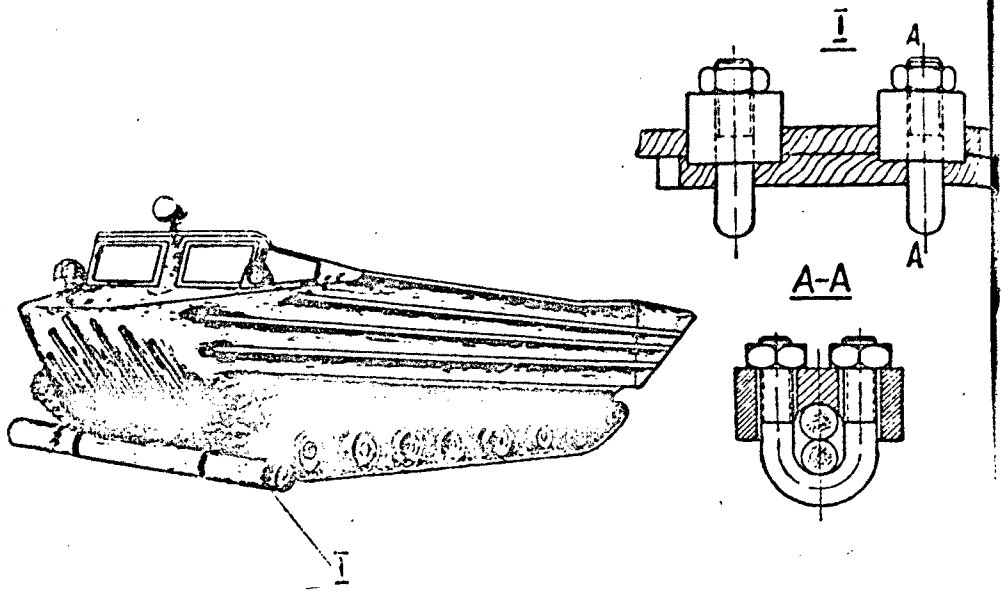

Fig. 20. Self-recovery
Attach log to tracks with rope. Single-turn rope wrapping is possible.

Winch Troubles and Remedies

Trouble	Cause	Remedy
Oil leaks through reduction gear seal at flange end. Oil leaks from reduction gear housing at drum shaft end	Worn spring-loaded seal	Replace seal
	Worn bronze bearings	Replace bearings
Transfer case flange rotates, but propeller shaft is at rest	Shorn safety bolt	Replace safety bolt. I new bolt is shorn again, reduce winch load or install a stronger bolt

ELECTRICAL EQUIPMENT
(Fig. 21)

Trouble	Cause	Remedy
With engine at rest and ground circuit closed, depressing voltameter button does not produce battery voltage reading	1. Blown out fuse on battery circuit breaker block	Replace fuse. In case o repeated fuse blow ou check circuit and eliminate short
	2. Poor connection between wire and battery terminals	Connect properly
	3. Ground switch is at fault	Replace ground switch
	4. Voltameter is at fault	Replace voltameter

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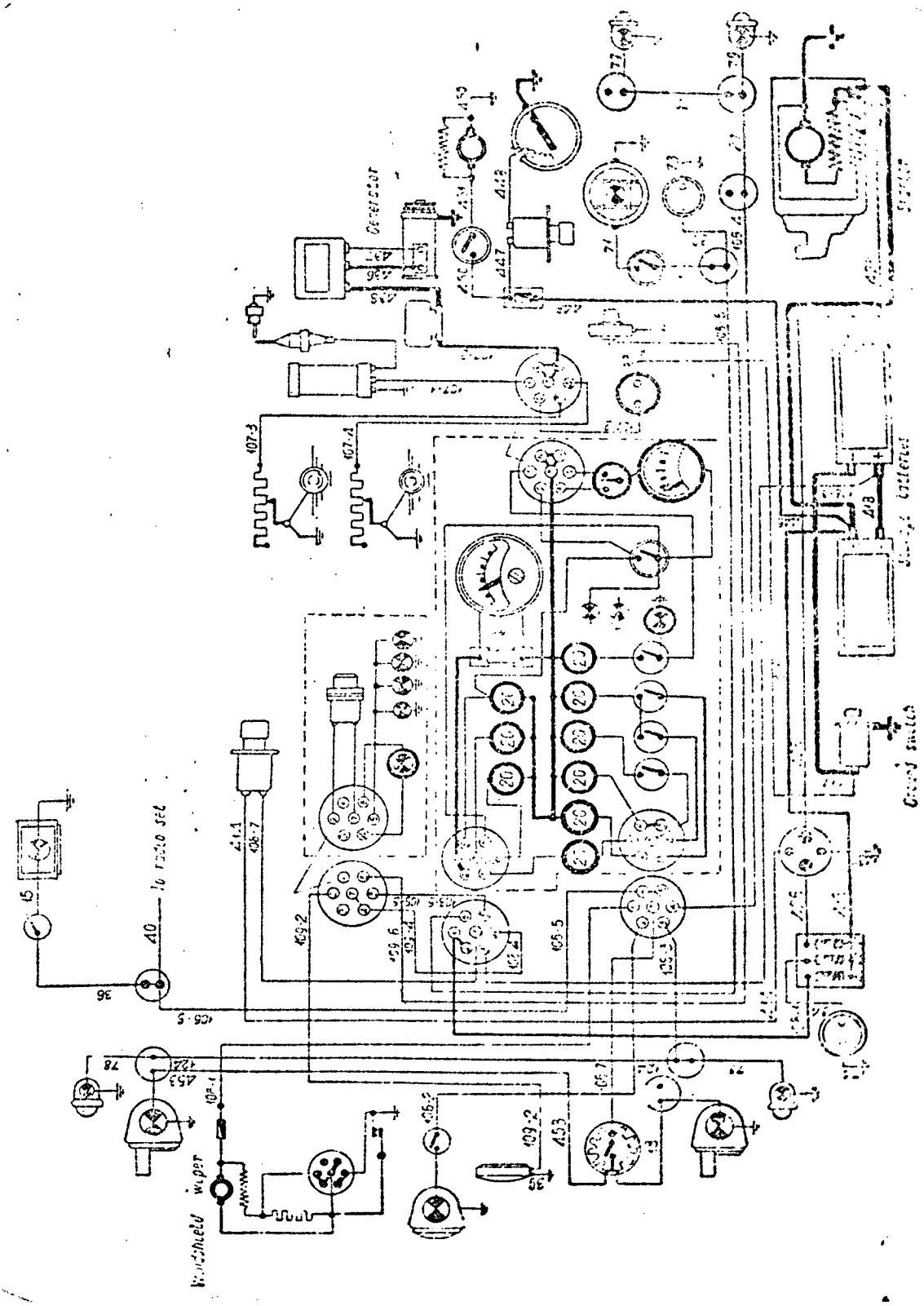

Fig. 21. Electrical equipment key diagram

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Trouble	Cause	Remedy
With engine running at medium speed and ground circuit closed, depressing voltameter button does not produce generator voltage reading	1. Broken or disconnected voltameter wire	Find faulty point and connect
	2. No generator exitation	Check generator for serviceability
	3. Faulty voltameter	Replace voltameter
	4. Faulty generator regulator unit	Correct fault
Horn does not operate	1. Cut-out thermo-vibration circuit breaker in horn circuit (side instrument panel)	Cut in breaker by depressing its control button
	2. Faulty horn button	Replace button
	3. Faulty horn:	
	a) Horn is out of adjustment	Adjust by using adjusting screw
	b) Broken electromagnet coil	Have fault corrected in repair shop
	c) Burnt horn breaker points	Clean points
... starter switched on, starter relay comes in action but starter armature does not revolve	1. Discharged storage batteries	Have batteries charged
	2. Loose battery terminals	Tighten terminals
	3. Poor contact between starter switch laminations	Correct fault
When ground switch is switched on, oil pressure pick-up unit warning lamp does not light up	1. Lamp is burnt out	Replace lamp
	2. Cut-out thermo-vibration breaker of circuit (side instrument panel)	Cut in breaker
	3. Faulty oil pressure warning pick-up unit	Replace pick-up unit
Windshield wiper fails to operate	1. Faulty wiper motor or linkage	Correct fault
	2. Cut-out circuit breaker (side instrument panel)	Cut in breaker
	3. Faulty switch	Repair or replace switch
With read light switch on, one head lamp fails to burn	1. Burnt filament	Replace bulb
	2. Loose connection at head lamp terminals or junction box	Connect properly
Both head lamps fail to burn	Cut-out thermo-vibration circuit breaker (side instrument panel)	Cut in breaker by depressing its button
With spot light switched on, spot light bulb does not burn	1. Burnt-out bulb	Replace bulb
	2. Cut-out thrermo-vibration circuit breaker (side instrument panel)	Cut in breaker by depressing its button
	3. Faulty spot light switch	Repair or replace switch

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Trouble	Cause	Remedy
Shutter lamp fails to burn	1. Cut-out thrermo-vibration circuit breaker (side instrument panel)	Cut in breaker by depressing its button
	2. Burnt-out bulb	Replace bulb
	3. Faulty switch	Repair or replace switch
	4. Loose wire connection to lamp or junction box	Connect properly
One of marker lamps fails to burn	1. Burnt-out bulb	Replace bulb
	2. Loose wire connection to lamp or junction box	Connect properly
Marker lamps fail to burn	Loose wire connection to junction boxes of lamps at fault	Connect properl

RADIO SET

For the radio set operating instructions, troubles and remedies, see the appropriate Radio Set Brief Technical Manual included in the set of the carrier technical papers.

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SUMMER AND WINTER OPERATION OF CARRIER

SUMMERIZATION OF CARRIER

A. General Instructions

1. The carrier should be prepared for summer operation when the ambient temperature above +5°C has set in. It is advisable that the summerization operations be performed as part of the Maintenance No. 1 or No. 2.

2. When changing from the winter into the summer operation, replace the winter lubricant in all mechanisms and units with summer lubricant in compliance with the Lubrication Chart.

3. As in summer the air is dust-laden, it is imperative that oil in air-cleaners be changed every 8 to 10 operating hours.

B. Service on Fuel System

(Fig. 22)

1. Drain the winter diesel fuel from the tanks.

2. Wash the fuel tanks by pouring 10 to 15 *lit* of clean summer diesel fuel into each tank and draining the fuel through the drain holes into each vessels.

3. Thoroughly wash the preliminary and final fuel filters.

4. Fill the tanks with summer diesel fuel.

C. Service on Lubrication System

1. Warm the engine and the carrier units by driving the vehicle and immediately after this drain the warm oil from the engine, gearbox, transfer case, final drives and axle drive.

2. Flush the engine crankcase with fresh heated oil. Flush all the other units with diesel fuel or heated oil.

3. Wash the preliminary and final oil filters in heated oil. The use of kerosene for washing the lubrication system is strictly forbidden.

4. Fill the engine and all the other units with fresh oil in compliance with the Lubrication Chart.

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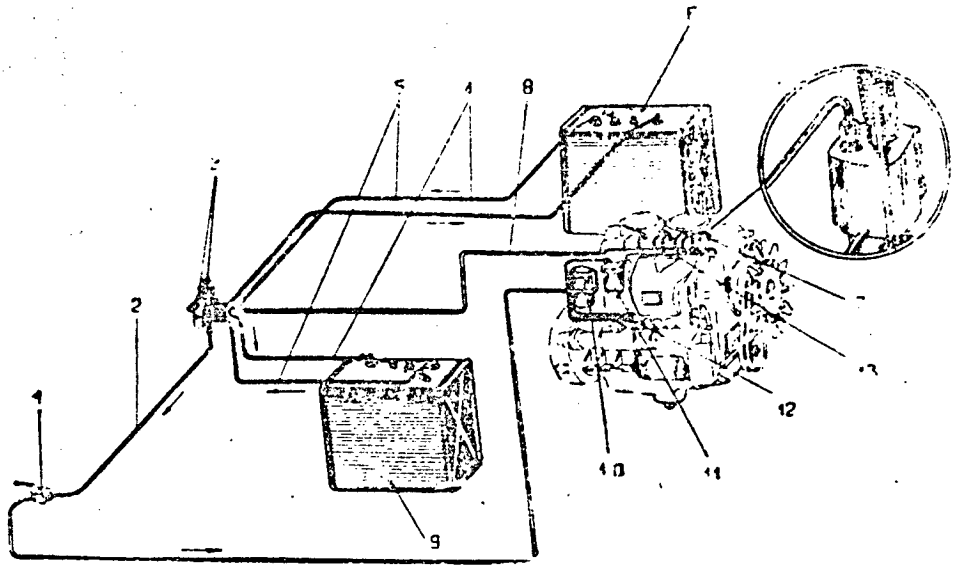

Fig. 22. Fuel system layout:
1—hand booster pump; *2*—supply line; *3*—distributing cock; *4*—fuel drain lines; *5*—intake lines; *6*—R.H. tank; *7*—pump and injector unit; *8*—fuel drain line; *9*—L.H. tank; *10*—preliminary fuel filter; *11*—final fuel filter; *12*—fuel pump; *13*—engine fuel supply line

D. Service on Cooling System

1. Drain the antifreeze from the system.
2. Thoroughly check the condition of the water pump, radiator, water preheating system and piping. Correct the deficiences disclosed.
3. Remove the scale by flushing the cooling system with one of the following cleaning solutions:
a) 0.5 *lit* of kerosene and 1 *kg* of soda ash to 10 *lit* of water;
b) 250 *cu. cm.* of hydrochloric acid to 10 *lit* of water.
Do not use caustic soda solution for flushing the cooling system.
Make flushing as follows:
a) Using the soda ash solution:
1. Remove the thermostat.
2. Fill the cooling system with the solution.
3. Start the engine and run it at a low speed for 10 to 15 *min.*
4. Leave the solution in the system for 10 to 12 *hr.*
5. Start the engine and run it for 5 to 10 *min.*
6. Stop the engine and drain the solution.
7. Flush the system and then fill it with clean soft water.
b) Using the hydrochloric acid solution:
1. Remove the thermostat.
2. Fill the colling system with the solution.

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3. Start the engine and run it at a low speed for 1 *hr* so that the engine temperature reaches 90°C.

4. Stop the engine and drain the solution.

5. Thoroughly flush the system and then fill it with soft clean water.

In the course of operation of the vehicle change the water in the cooling system as seldom as possible.

E. Service on Storage Batteries

To prepare the storage batteries for summer operation see "Brief Maintenance Instructions for Type 6 MCT-140 or Type 6 СТЭН-140 Starter Dry Storage Batteries" included in the set of the carrier technical papers.

WINTERIZATION AND WINTER OPERATION

A. General Information

To provide for trouble-free winter operation of the carrier, winterize the cooling system, preheating system and all the units before the cold weather has set in.

The winterization operations should be performed as part of Maintenance No. 1 or No. 2.

In winter weather follow the instructions given below:

1. If the ambient temperature is below +5°C start the cold engine only after using the preheater.

2. Use only winter diesel fuel.

3. Do not crank the cold engine by the starter.

4. See that there is no water inside the carrier hull as frozen water may become the source of inefficiency of the carrier controls.

B. Service on Fuel System

1. Drain the summer diesel fuel from the tanks.

2. Flush the tanks by pouring 10 to 15 *lit* of clean winter diesel fuel into each tank and draining the fuel from the drain holes.

3. Thoroughly wash the preliminary and final fuel filters in diesel fuel or kerosene.

4. Fill the tanks with winter diesel fuel.

The winter diesel fuel must be used at a temperature of not below —30°C.

In case of lower temperatures blend the diesel fuel with lamp kerosene or use a special arctic grade of fuel (see "ЯМЗ Engine Technical Manual").

C. Service on Lubrication System

1. Warm the carrier engine and units by driving the carrier and immediately after this drain the warm oil from the engine, gearbox, transfer case, final drives and axle drive.

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2. Flush the engine crankcase with fresh heated oil. Flush all the other units with diesel fuel or with heated oil of the grade corresponding to that of the oil used in the unit.

3. Wash the preliminary and final oil filters in heated oil.

4. Fill the engine and all the units with fresh oil in compliance with the Lubrication Chart.

5. Remove the presure gauge piping, wash it in gasoline, blow out and reinstall.

D. Service on Cooling System

1. Drain the coolant from the system.

2. Thoroughly check the condition of the water pump, radiator, radiator shutters, preheater and piping. Correct the deficiences disclosed.

3. Fill the system with grade 40 antifreeze.

When using antifreeze, observe the following requirements:

1. The amount of cold antifreeze should be by 4 to 5 *lit* less than that of cooling water.

2. Warm antifreeze to a temperature of not above 80 to 90°C before pouring it into the system.

3. In the course of operation refill the system only with water. (In case of antifreeze leakage refill with antifreeze of the same grade).

4. During every maintenance check the condition of the antifreeze by its specific gravity (this should be 1.055 to 1.07).

If the antifreeze specific gravity is found to have increased, add water. In case the specific gravity of the antifreeze has decreased, add fresh antifreeze of the same grade.

5. Do not allow even small amounts of diesel fuel, gasoline, kerosene or oil to get into the antifreeze to avoid foam formation.

6. Keep antifreeze in a clean closed container and take care of it.

7. Do not suck antifreeze into the hose with your mouth as antifreeze is poisonous.

Antifreeze-poisoning is lethal!

E. Service on Storage Batteries

For winterization service on storage batteries, see "Brief Maintenance Instructions for Type 6 MCT-140 or Type 6 СТЭН-140 Starter Dry Storage Batteries".

PREHEATER UNIT

Purpose

The ЯАЗ-М204ВКр engine preheater unit is designed to facilitate the engine starting at low ambient temperatures by heating the engine body and oil in the crankcase pan.

The design of the preheater unit allows for bleeding the engine fuel system to expel the trapped air.

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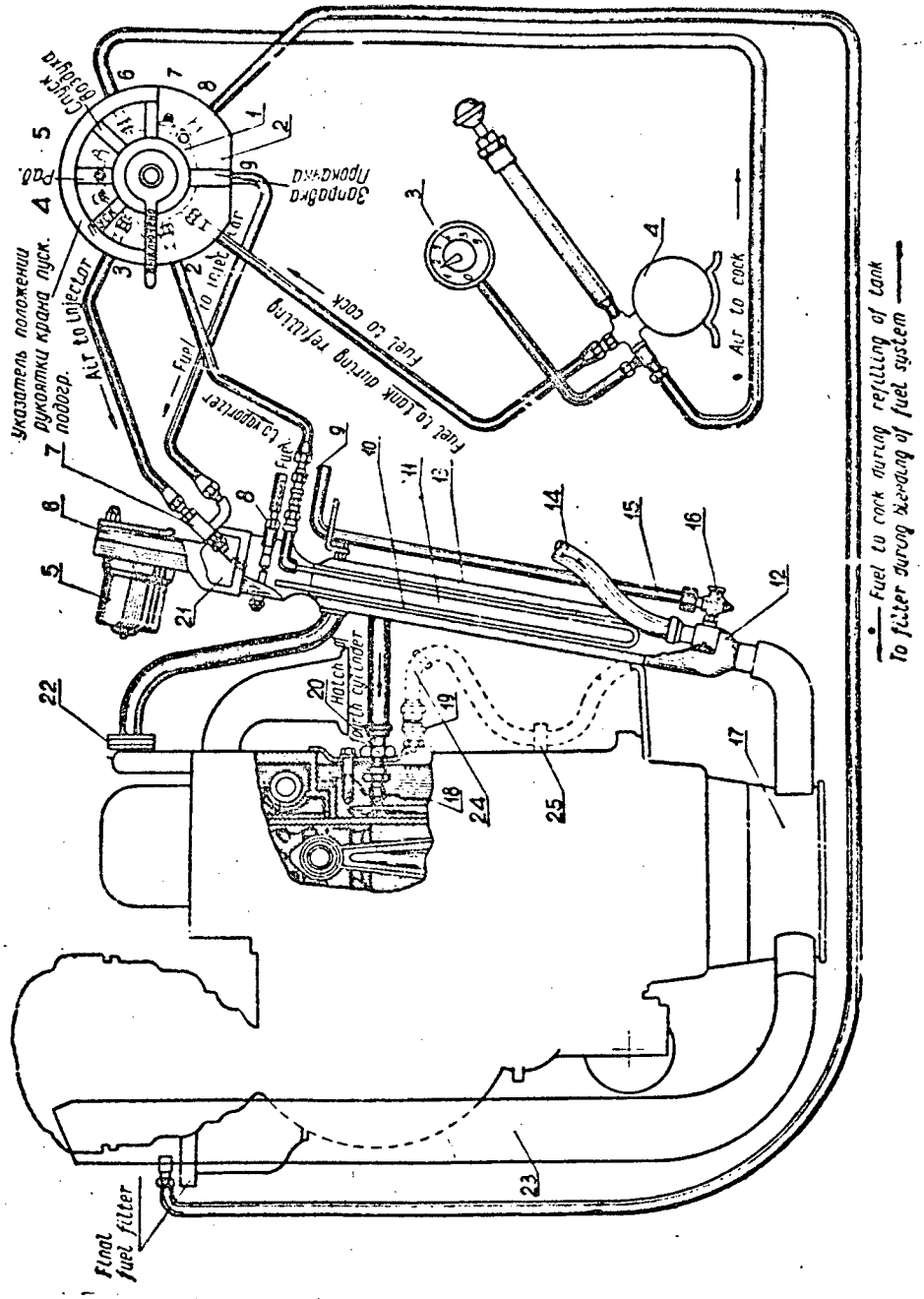

Fig. 23. Engine preheater layout

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Construction of Preheater Unit

The preheater unit is composed of the following main units (see engine preheater unit layout in Fig. 23):

preheater *12*; fan *6* with electric motor and injector assembly; fuel tank and air pump assembly *4*; distributing cock *1*; igniter *8*.

The preheater is mounted on the left-hand side of the engine, as viewed from the flywheel, and is connected to the engine cooling system through fittings *18*. These fittings are screwed through the covers of the hatches Nos. 1 and 4 into the cylinder block water jacket bosses in place of the plugs.

The preheater is a welded single-pass boiler consisting of heating chamber *11* and casing *13*. The outer surfaces of the heating chamber walls and the inner surfaces of the casing form a water jacket.

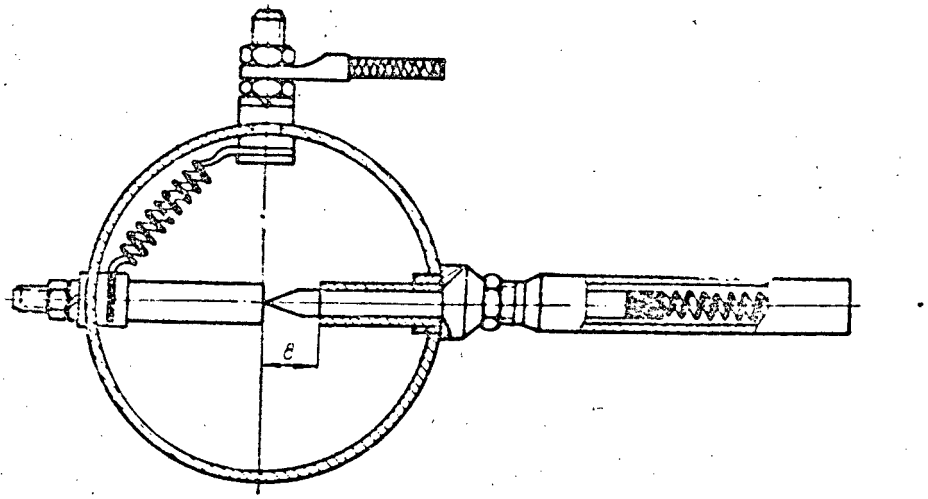

Fig. 24.

The upper portion of the preheater forms a neck, fitted into which is igniter *8* comprising a carbon and a steel electrodes and a resistance (Fig. 24). The igniter electrodes permanently butt against each other. The igniter is operated by its switch installed on the oil filter bracket.

Installed in the combustion space of the heating chamber is vaporizer 10 (Fig. 23) composed of a V-shaped steel pipe. One end of the vaporizer pipe is fitted in the neck at the point of contact of the igniter electrodes. The other end of the pipe is fitted in the neck with the help of a nipple. The free end of the nipple carries vaporizer throttle *9*.

The vaporizer throttle meters fuel supply to the vaporizer by passing fuel through a 0.35+0.40 *mm* diameter jet.

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Mounted on the left-hand side of the preheater is filler hose *14* through which water (or other coolant) passes into the preheater jacket.

To drain water from the preheater jacket in the event the vehicle is not in use for a long time, drain cock *16* is provided on the lower portion of the preheater. The drain cock is operated by using handle *15* which extends to the preheater top.

The fan, electric motor and injector are assembled in a common casing which is attached to the preheater neck by means of two thumb nuts.

The purpose of the assembly is to supply the heating chamber with the air necessary for the fuel-air mixture to burn, as well as to get the vaporizer ready to operate. The assembly includes the following main components:

a) Electric motor *5*, type МЭ-230, 24 V, 3,800 *r.p.m.*;

b) Fan impeller attached to the motor shaft through the use of an adapter;

c) Pneumatic injector *7* metering and atomizing fuel. Fuel metering is effected by passing fuel through a 0.2 *mm* annular space between air pipe *2* and injector body *1* (Fig. 25).

Fuel is atomized through a 1 *mm* dia. discharge hole in the injector body under the force of compressed air.

d) Injector shield *21* (Fig. 23) which deflects the gaseous fuel coming out of the vaporizer when it is operating, and facilitates mixing of the gaseous fuel with the air supplied by the fan.

The fuel tank with the air pump is installed in the R. H. side compartment between the frames Nos. 2 and 3. When not in use, the pump piston rod is held in place by a special screw located in the pump attaching nut.

With the help of the air pump the injector is supplied with fuel and air which are fed under moderate pressure indicated by pressure gauge *3*.

N o t e. Air for feeding the injector is taken from the upper portion of the same tank.

Besides, the pump is used for bleeding the engine fuel system (see "Bleeding Fuel System").

The distributing cock of the preheater unit is mounted on a bracket provided in the R. H. side compartment. The cock handle is set in the required position by referring to cock handle position index *2* (Fig. 23).

The purpose of the distributing cock (Fig. 26) is designed to successively distribute fuel and air from the fuel tank to the working portion of the preheater unit. The cock consists of cock body *5*, upper rotary ring *3*, lower rotaty ring *8*, spring *7*, compressing rings *3* and *8*, cock body cover *4*, spindle *2*, handle *1* and nine connections *6*.

N o t e. The fourth and seventh connections are plugged up.

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Operation of Preheater Unit

The design of the preheater unit allows for heating the engine irrespective of whether the engine cooling system uses water, antifreeze or some other fluid. Depending on kind of coolant used, engine preheating is effected by two methods.

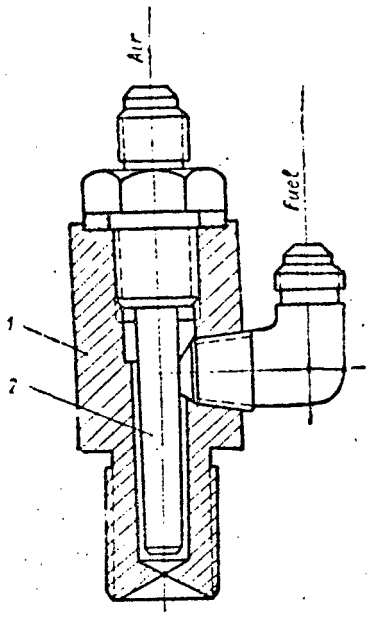

Fig. 25.

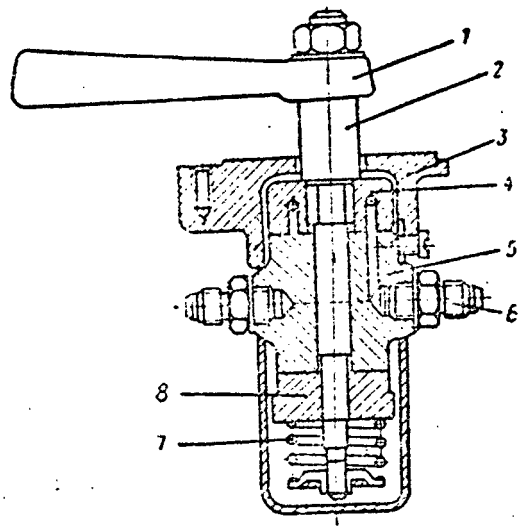

Fig. 26.

1. If the engine cooling system uses water, preheating is effected by the steam which is generated in the preheater jacket as water heats and evaporates. The steam enters the cylinder block water jacket through fitting *20* (Fig. 23) installed in the hatch No. 4 and gives off its heat to the cylinder block. The condensate settling during this process is drained through the open cock of the water pump and the heat exchanger drain cock.

2. If the engine cooling system is filled with coolant, preheating is effected by heating the coolant in the preheater jacket. The coolant is heated by heat transferred through the heating chamber walls, whereas the heating chamber obtains the heat generated by burning the gaseous fuel coming out of the vaporizer.

As the coolant heats in the preheater, its hotter portion rises into the upper section of the preheater due to the difference in the specific gravity between the heated and cold portions of coolant (thermo-syphon principle). The coolant flows from the upper section of the preheater through a rubber hose and the upper outlet connection into the cylinder block water jacket where it gives off the heat to the cylinder block walls.

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As the coolant cools down it returns through fitting *19* of the No. 1 cylinder hatch and the filler hose into the lower section of the preheater, whereupon the cycle is repeated. Thus, due to the thermo-syphon circulation, the coolant flows in the closed circuit: preheater-cylinder block-preheater.

Starting and Operation of Preheater Unit

If water is to be used in the engine cooling system (by the time of starting the system should be empty), start the preheater unit as follows:

1. Close the radiator shutters.
2. Turn on the drain cocks on the water pump and heat exchanger. Turn off the drain cocks on the preheater and the cylinder block.
3. Before commencing the operation, make sure there is sufficient fuel in the preheater fuel tank and the distributing cock handle is in the "off" position. When the fuel tank is empty, it is allowed, as a matter of exception, to screw the tank fuel intake connection out of the upper section of the T-connection and to fill the tank so that the fuel level does not reach the side hole of the T-connection.

To operate the preheater unit at ambient temperatures of not below —30°C use grade ДЗ winter diesel fuel. For temperatures below —30°, use grade ДА arctic diesel fuel or a blend of 60 per cent of kerosene to 40 per cent of winter diesel fuel.

4. Check the igniter electrodes for operation by setting the igniter switch in the "on" position for a short while.
5. Remove the plug from the filler pipe.
6. Provide 8 to 10 *lit* of water.
7. Using the air pump, build up at least 2 *kg/sq.cm* pressure in the fuel tank.
8. Start the electric motor and open the fan intake hole half the way.
9. Switch on the igniter. The igniter energizing time should not exceed 3 or 4 *sec*.
10. With the igniter on, turn the distributing cock handle clockwise into the "Старт" ("Start") position. After this fuel and air pass from the preheater fuel tank through the distributing cock into the injector, where they are proportioned and discharged through the injector hole into the preheater neck in the form of fuel vapour. The fuel-air mixture comes in contact with the glowing electrodes, ignites and burns, forming a torch. The air stream fed by the fan carries the hot gases into the heating chamber, where the gases heat the vaporizer pipe.

Note. When the distributing cock is fully open in the "Start" position, the fuel-air mixture may fail to ignite due to the electrodes being flooded with cold fuel. To avoid this possibility, move the distributing cock handle somewhat off from the centre of the "Start" position. This will partially close the cock opening, thereby decreasing fuel delivery.

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11. Maintain the 2 *kg/sq.cm* pressure in the tank for 1 or 2 *min* so as to ensure stable operation of the injector.

12 After 1 or 2 *min* of the injector operation, establish pressure of not more than 1 *kg/sq.cm* and turn the distributing cock handle into the "Работа" ("Operation") position.

When the distributing cock handle is set in this position, air supply to the injector is discontinued and the fuel supply is directed through the vaporizer throttle to the vaporizer. The fuel entering the hot vaporizer pipe evaporates and comes out of the pipe in a gaseous state. The igniter is again switched on for 3 or 4 *sec* and, coming in contact with the glowing electrodes, the fuel ignites.

The air stream carries the hot gases into the heating chamber, where the hot gases maintain the vaporizer pipe temperature necessary for the next portion of fuel to evaporate, and heat the walls of the heating chamber. The used hot gases are taken into pipe *17*, which runs under the crankcase pan to heat the oil, and thence are exhausted through pipe *23* to atmosphere.

13. Set the fan shutter so as to ensure stable operation of the vaporizer.

14. Pour 2 *lit* of water into the preheater through filler hose *14*. Coming in contact with the hot walls of the heating chamber, water turns into steam which passes through the hose into the cylinder block water jacket.

15. Observe the condensate coming out of the drain cocks on the heat exchanger and water pump. The condensate must flow out in a solid stream. If interruptions are observed in the condensate stream, add water into the water jacket. Warm the engine for 15 to 25 *min*, depending on the ambient air temperature (—20 to —40°C).

16. If the preheater flame appears between the crankcase oil pan walls and pipe *17*, correct the fault or relieve the pressure in the tank down to 0.8 *kg/sq.cm* by using the following procedure:

Energize the igniter for 3 or 4 *sec* and operate the preheater injector for 5 to 8 *sec* by setting the distributing cock handle the "Start" position. After this energize the igniter once again for 3 or 4 *sec* while setting the distributing cock handle into the "Operation" position.

After warming the engine for 15 to 25 *min*, try to start the engine by the starter, with the preheater unit operating, and at the same time using the engine air preheater. If two or three attempts to start the engine have failed, continue warming the engine.

When the engine started, discontinue the preheater operation in the following sequence of steps.

1. Set the distributing cock handle into the "Спуск воздуха" ("Air escape") position. This will allow the tank pressure to drop to the atmospheric level, fuel supply to the vaporizer being thereby discontinued.

2. Switch off the fan electric motor.

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3. Install the filler pipe plug.

4. Turn off the drain cocks.

5. With the engine running at idle, fill the engine cooling system with heated water. The engine must not be run with the cooling system empty in excess of 2 *min* (considering the period between the instant of the engine starting and the commencement of filling the cooling system with water). Otherwice the water jacket walls may overheat and when coming in contact with cold water, crack.

6. Warm up the engine at a speed of 700 to 1,000 *r.p.m.*

7. Fill the preheater fuel tank with fuel. For the purpose set the the distributor cock handle into the "Заправка-прокачка" ("Filling-bleeding") position. This will allow the filtered engine fuel to flow from the final fuel filter into the preheater unit tank, the pointer of pressure gauge *3* indicating pressure increase. After filling the tank for 6 to 9 *min*, set the distributing cock handle into the "off" position with the engine running at a speed of 1,500 *r.p.m.*

During the above specified filling time, the pressures in the tank and the fuel line will become equal (the pressure gauge pointer stops) and, if the preliminary fuel filter is serviceable, the tank will be filled $^3/_4$ full of fuel.

8. Check the tank fuel level. The tank must not be filled up. If there is excess fuel in the tank, give the air pump 3 or 4 full strokes, with the distributing cock handle in the "Filling-bleeding" position and the engine at rest. This will bleed some fuel from the tank through the engine fuel system into the vehicle fuel tank. After the bleeding has been completed, set the distributing cock handle in the "off" position.

If the engine cooling system uses antifreeze, starting and operation of the preheater unit should be as follows:

Before filling the cooling system with antifreeze, remove partition 22 located between the engine upper water pipe and the preheater connection flange, disconnect the upper end of preheater filler hose *14* from the pipe; remove the plug from fitting *19* and install it in the lower end of the filler pipe; put pipe *24* (included in the maintenance kit) on fitting *19* connect pipe *24* with the filler hose and attach the filler hose to the generator bracket attaching bolt by means of clamp *25*.

Notes:

1. If the engine cooling system is to change from antifreeze to water, reinstall the partition; disconnect the filler hose from pipe *24* and attach it to the lower end of the filler pipe; remove pipe *24* from fitting *19* and install plug in fitting *19*.

2. For start and operation of the preheater unit see instructions given above.

3. Worm the engine for 25 to 50 *min*, depending on the ambient air temperatures (—20 to —40°C). During the heating period maintain 2 *kg/sq.cm* pressure in the preheater unit fuel tank.

4. Start the engine and discontinue the preheater operation as instructed above.

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Troubles and Remedies

Injector and Throttle Troubles

If the injector fails to deliver fuel when the unit is being started, or discontinues fuel delivery in the course of operation, clean the clogged injector by using the following procedure:

1. Screw out the injector nipple with the air pipe.
2. If found clogged, wash the pipe in clean diesel fuel and then blow out.
3. If the injector discharge hole is clogged, clean out the hole, using wire, not more than 1 *mm* in diameter.

Malfunctioning of the vaporizer (flame breaking or blow-out) may be met with. To correct the faults, remove the vaporizer throttle and clean it out. To clean out the throttle jet, use only soft wire, not more than 0.35 *mm* in diameter.

Distributing Cock Troubles

If the cock connections are not tight, disconnect the piping from the cock, remove the cock from the bracket, disassemble the cock and wash all cock parts in diesel fuel. If this procedure fails to ensure the cock tightness, lap the cock plug to the plug seat in the cock body (in the case of a plug-type cock).

Igniter Troubles

The igniter electrodes may become clear of each other or the carbon electrode glow may be insufficient to ignite the fuel.

If the electrodes are found not to butt against each other, remove the carbon electrode holder, take the electrode out of the holder and check the holder spring for functioning. If the spring is in proper condition, remove the carbon deposit from the holder inside and the electrode outer surface.

If the carbon electrode glow is insufficient (the electrode is brought to red heat instead of white heat), first of all check whether the electrode is properly pointed. If the electrode pointing is found worn, remove the electrode from the holder and taper it to a small angle.

If, after tapering, the electrode glow is still insufficient, check whether the insulation of the steel electrode threaded portion and the resistance bolt insulation are in proper condition. Apart from this, check whether the wire is securely soldered to the carbon electrode holder. If the soldering is defective, the wire and the spring will readily come out of the carbon electrode holder when pulled at.

Bleeding Fuel System

To bleed the engine fuel system in order to expell the trapped air, proceed as follows:

1. Check that there is sufficient fuel in the preheater unit tank (the tank should be at least 3/4 full).

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2. Set the distributing cock handle in the "Filling-bleeding" position and give the air pump rod several vigorous strokes. The pressure thus developed will force the fuel from the preheater tank through the entire engine fuel system until the fuel is bled through the return line into the vehicle tank, carrying away the air bubbles.

3. After the fuel system is bled and the engine is started, fill the preheater unit tank with fuel by setting the distributor cock handle first in the "Air escape" and next in the "Filling-bleeding" position.

4. When the preheater tank is filled, set the distributor cock handle in the "Off" position.

WARNING!

1. To avoid entry of air into the engine fuel system, never set the distributing cock handle in the "Filling-bleeding" position if the engine is at rest and there is pressure in the preheater fuel tank.

2. Before draining water from the engine cooling system and the preheater unit, warm the engine until the water temperature is +80 to +85°C.

3. To avoid wearing the carbon electrode point (which entails excessive current consumption), do not operate the igniter idle.

4. Never crank the cold engine by the starter.

STORAGE OF CARRIERS

The present instructions specify temporary storage of the carriers for a period of not more than 6 months and pertain to the vehicles that are not to be used for more than 30 days.

Storage of the vehicles consists in:

a) Preparation for storage;
b) Keeping storage;
c) Removal from storage.

If the vehicles are to be kept in storage for more than 6 months, every 6 months try out the carriers by driving them 15 to 20 *km* or perform a stationary try-out (with the tracks removed) for one hour by running the carrier mechanisms 5 to 10 *min* in each gear, operation of the screws included. After every driving or stationary try-out perform all the operations prescribed herein. The vehicles so kept in storage should not be summerized, but should be kept filled with winter grade fuel and oil at all times.

Preparation for Storage

General Information

1. When carrying out corrosion prevention treatment in the open, the vehicle should not be exposed to adverse atmospheric conditions such as rain, snow, fog or dusty wind.

2. Paint the vehicles at an ambient temperature of not below +8°C.

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3. Install supports under the tracks (logs, poles or planks) 1 metre longer than the length of the track on the ground.

4. Disassembly, washing and assembly of units (air cleaners, fuel and oil filters, etc.) should be made indoors, shelving, baths and other necessary facilities being provided for the purpose.

5. Remove storage batteries from the vehicle.

If the vehicle is to be stored in a cold shed in winter, also remove the radio set.

Treating Hull

To give the hull anticorrosion treatment, proceed as follows:

1. Remove dust, dirt and rust from the outer and inner surfaces of the hull.

2. Check the welds for cracks.

3. Check that bosses, lugs, brackets, cover plates, stops, plugs, threads and fastenings are present and serviceable.

4. Check that the shutters and hatch covers are a proper fit (fit up, if necessary).

5. Restore the damaged paintwork (if necessary, repaint the whole hull).

Treating Drainage System

To give the drainage system anticorrosion treatment, proceed as follows:

1. Make the outer surfaces of the pumps and piping free from dust and dirt.

2. Check the piping attachment fittings and joints.

3. Apply a coating of lubricant to the inside surfaces of the pumps by using the following procedure:

a) Disconnect the common pipe line rubber canvas hose from the pumps downstream of the cut-out valve;

b) Place a wooden plug in the pipe leading to the pumps.

c) Screw out the pump filler plugs, pour 1.5 *lit* of heated engine oil into each pump through the filler holes and reinstall the plugs.

d) Start the engine, shift the gearbox into the first gear, run the propulsion screws at the minimum speed for 15 to 20 *min* making 3 or 4 intervals, 1 to 2 *min* each, so that the screws are brought to a complete stop. Then stop the engine.

e) Remove the plug, drain the oil from the pumps and pipe lines and reinstall the rubber canvas hose.

Treating Engine

To give the engine anticorrosion treatment, proceed as follows:

1. Apply a fresh oil coating to the lubricated surfaces of the engine parts. For the purpose warm the engine up to a temperature of +50°C and scavenge the cylinders.

To warm the engine, run it with the vehicle at rest, by using the following procedure:

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a) Close the radiator shutters.

b) Pull the steering clutch and brake control levers all the way backward and lock them in this position.

c) Start the engine.

d) Set the engine speed at 1,700 to 2,000 *r.p.m.* and run the engine for 1.5 to 2 *min.*

e) When the warming is completed, scavenge the engine cylinders to expell the remaining burnt gases. For the purpose, before stopping the engine, shift into the highest gear and shut down the engine by rapidly operating the fuel cut-off control. This will allow the crankshaft to be driven several revolutions by the power transmission running under its own momentum.

2. As soon as the engine has been warmed and scavenged, remove the injectors and pour through the injector holes of each cylinder 35 to 40 *cu.cm* of specified engine oil heated to a temperature of 75 to 80°C.

3. The oil employed for lubricating the cylinder faces should be dehydrated by being heated at a temperature of 115 to 120°C until no foam is formed on the oil surface.

4. After oil has been poured into the cylinders, crank the engine 5 to 6 revolutions by hand.

5. Install a wooden plug smeared with solid oil into the exhaust pipe.

6. Remove dust, dirt and rust from the outer surfaces of the engine, engine supports, engine compartment partitions and casings. Apply a coating of solid oil to the unpainted surfaces of the ferrous metal parts.

Apply a thin coating of used oil to the exhaust manifold. Restore the damaged paint coating on painted parts.

7. Starting of the anticorrosion treated engine is not permissible.

Treating Lubrication System

1. Wash the oil filters.

2. If winterization is due, replace the oil with the winter grade.

3. With no winterization due, oil should be changed in case the engine has been run at least 20 operating hours.

4. Apply a thin coating of engine oil to the outer surfaces of the oil pipes.

Treating Fuel System

1. Remove dust, dirt and corrosion from the outer surfaces of the fuel tanks, pipes and booster pumps.

2. Wash fuel filters.

3. Restore the damaged paint coating.

4. Apply solid oil to fastenings and other parts made of ferrous metals.

5. Apply used aviation oil or engine oil to the joints of the control linkage and the fuel system pipes.

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6. If winterization is due, replace the fuel with the winter grade. Otherwise drain 2 to 3 *lit* of fuel sediment from each tank and replenish the fuel to the specified level.

7. The fuel tanks should be kept full of diesel fuel.

Treating Cooling System

1. Remove dust, dirt and rust from the outer surfaces of the radiator, pipes and heat exchanger.

2. Restore the damaged paint coating.

3. If scale is found, flush the cooling system.

4. Apply solid oil or aviation oil to the unpainted surfaces of the ferrous metal parts. Check the radiator filler cap for proper condition. If rust is found, disassemble the cap (after the engine has been treated) and remove the rust.

5. If winterization is due, drain water from the cooling system.

6. Wipe all the cooling system rubber canvas hoses dry. If ply separation, swelling or other signs of deterioration are found, replace the hoses. Remove dirt and rust from the hose clamps and apply protective grease to the clamps.

Treating Power Transmission

1. Remove dust, dirt and rust from the outer surfaces of the engine clutch, brakes, gearbox, transfer case, axle drive, final drives, propeller shafts and control linkage.

2. Restore the damaged paint coating.

3. Apply solid oil to unpainted surfaces of the ferrous metal parts. Apply engine oil to the pivots of the control linkage and levers.

4. Change lubricant in the power transmission units in accordance with the specified changeover periods. If winterization is due, change the lubricant irrespective of the changeover specifications. When changing the lubricant, flush the housings of the power transmission units with diesel fuel or heated oil and fill with the specified grades of lubricant in accordance with the weather conditions.

5. Upon completion of the treatment set the gearbox control lever into the neutral position and shift the rest of the control levers all the way forward.

Treating Winch

1. Remove dust, dirt and rust from the outer surfaces of the winch.

2. Unwind the winch cable and clean the cable and the winch drum.

3. Restore the damaged paint coating.

4. Apply used engine oil to the unpainted surfaces of the ferrous metal parts.

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Treating Track Assembly

1. If the anticorrosion treatment is made while winterizing the vehicle, inspect some of the road wheels.

2. To inspect, remove one road wheel on each side of the vehicle. If water, dirt or rust are found in the road wheel hubs, remove the rest of the road wheels. Clean the removed road wheels of dust, dirt and rust. Wash the road wheel bearings in gasoline and pack them with winter lubricant.

Pay particular attention to cleanliness of the labyrinth seals of the road wheels and their arms. The surfaces of the road wheels (except those fitted with rubber tyres) should be painted with nitro-enamel or coated with solid oil.

Wash the road wheel tyres with water and wipe them dry. Upon reinstalling the road wheels replenish the bearing lubricant as prescribed for maintenance services.

In case the inspection of the two road wheels removed first shows that the lubricant is adequate and the parts are in serviceable condition, do not remove the other road wheels. The removal of the road wheels should be registered in the vehicle Log Book so that during the next inspection some other road wheels are removed.

3. Remove the idler wheel cranks from a few vehicles and check their condition. If rust is found, remove the idler wheel cranks from the rest of the vehicles and clean the cranks of dirt and rust.

Apply solid oil to the idler wheel crank shafts and the crank-to-hull gearing. Record the removal of the idler wheel cranks in the Log Book.

4. The tracks should be cleaned of dirt and wiped with waste cloth. Then coat the tracks with the mixture of 80 per cent of bitumen to 20 per cent of diesel fuel or with "Кузбасс" (Kuzbass) bituminous paint. When treating the tracks, guard the wheel tyres against the preservative compound or the bituminous paint.

Treating Electrical Equipment

1. Before placing the vehicles in storage, all the electrical system units and instruments as well as the wiring should be inspected fully furnished with the specified parts and made serviceable.

2. All the electrical equipment except for the storage batteries should be in place on the vehicle.

3. To give the electrical equipment anticorrosion treatment, proceed as follows:

a) Make external inspection and clean the outer surfaces of all the units and instruments of lubricants, moisture, dust and corrosion.

b) Check all the units and instruments for serviceability.

c) Correct all the faults detected on the site or in the workshop.

d) Restore the damaged paint coating. Apply a thin coating of

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petrolatum to the unpainted surfaces suspectible to rust. Prevent the preservative oil from getting on the contact surfaces.

e) The head lamps, horn, generator regulator unit, storage battery circuit breaker block, starter relay, ground switch and wire shoes (for connecting to the storage batteries) should be wrapped in oil-paper.

f) The storage batteries removed from the vehicles should be forwarded to the charging shop to be prepared for storage.

At the charging shop clean the mastic surface with 10 per cent solution of aqua ammonia or soda ash, then wash the mastic surface and the edges of the battery box with water and wipe them dry with clean rags. Apply a thin coating of petrolatum to the cell connections and terminals.

Treating Maintenance Kit Equipment

Clean, dress and paint the tools, appliances and spare parts. Coat the unpainted items with solid oil.

Stow the maintenance kit equipment in the vehicle in compliance with the Maintenance Kit List.

The fire extinguishers should be charged and ready for action.

Keeping Carriers in Storage

1. Do not start the engines of the carriers kept in storage.

2. Throughout the warm season the engine cooling system should be kept filled with boiled water. In the cold season the cooling system should be kept empty. If the cooling system is filled with antifreeze, the latter is allowed to be left in the system.

3. In summer weather the engine lubrication system should be filled with summer grade oils.

4. In winter weather the lubrication system should be kept empty, safe for the vehicles kept in warm indoor storage.

5. The vehicle fuel tanks should be kept full of fuel at all times. In locations where extremely low temperatures are encountered, grade "ДА" arctic diesel fuel should be used in the winter period to fill the vehicle tanks.

6. The housings of the power transmission units should be filled with oil in accordance with the season.

7. In case of storage in the open, the vehicles should be protected with canvas covers. The covers should so stretched over the vehicles as to avoid retaining water or snow.

Maintenance of Carriers Kept in Storage

1. Weekly make external inspection of the vehicles. Check that the vehicles are properly protected with the canvas covers and remove the retained rain water or snow from the cover.

2. Once a month, on the day of weekly inspection, inspect the

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vehicles by removing the canvas covers and opening the hatches. Proceed as follows:

a) Examine the outer surfaces of the vehicle units, parts and equipment for rust.

b) See that there is no water (srow) dust and dirt.

c) Check condition of the preservative oil on the outer surfaces of the units, parts and equipment.

d) Check condition of the paint coating.

e) Look for leaks of fuel, coolant and oil from the vehicle units.

f) Check condition of the rubber canvas hoses, rubber, leather and canvas articles.

g) Check that the engine exhaust system is securely plugged.

h) Check condition of the canvas covers, cases and mats.

3. Correct all the faults detected. Bleed the fuel system by operating the hand fuel feed pump.

4. In the warm season, once a month, during the regular inspection, pour oil into the engine cylinders. As distinct from the anticorrosion treatment procedure, oil should be poured into the cylinders without running the engine.

5. In clear sunny summer weather, air the vehicles. To do this, open the upper engine hatch during the regular inspection. Allow the canvas covers cases mats, etc. to dry.

Care of Electrical Equipment

1. Every two weeks, check the electrolyte level in the storage batteries. Add distilled water to bring the electrolyte to the specified level.

2. Once a month inspect the storage batteries and carry out compiete recharging. Check the specific gravity and level of the electrolyte. Wipe the mastic surface, battery box and rack with a rag soaked with 10 per cent solution of aqua ammonia or soda ash, then wipe the box, mastic and rack with a rag soaked with water and wipe them dry with clean waste cloth.

Note. To control the condition of the electrical equipment manufactured or overhauled 3 years ago or earlier, remove the generator, starter, generator regulator unit and the starter relay from one of the vehicles whose guarantee term has expired and examine its equipment in the workshop. For the purpose the electrical equipment should be partially or completely disassembled (with the seals removed). If the inside of the starter or generator is found attacked by rust, the units should be repaired. In this case remove the electrical equipment (which has not been removed for checking until now) identical with that found faulty from all the vehicles of the same year of manufacture as the one involved in the check. The electrical equipment which needs complete overhaul should be sent for repair or replaced.

3. Correct the faults found in the electrical equipment, remove dirt and rust and repaint.

Upon reassembly install the electrical equipment on the vehicle and check for serviceability.

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Removing Carriers from Storage

1. To remove the vehicle from temporary storage and to prepare them for service, proceed as follows:

a) Remove the slushing oil from the unpainted outer surfaces of the units, parts and equipment.

b) Reinstall the radio sets and storage batteries.

c) Remove the plug from the exhaust pipe.

d) Check the fuel level in the tanks. Drain 2 to 3 *lit* of fuel from each tank sediment chamber to remove sediment.

e) Make external inspection of the track assembly to see whether the track tension is correct and the road wheels are in proper condition.

2. If the vehicle summerization is due, proceed as follows:

a) Fill the cooling system with boiled water.

b) Fill the engine lubrication system with summer grade (without flushing the system). In the case of vehicles that are put in storage with the lubrication system filled, replace the winter oil with the summer grade.

c) To build up pressure in the lubrication system, disengage the engine clutch and turn the engine crankshaft by energizing the starter several times.

d) Start the engine and warm it up.

e) Replace the winter lubricant with the summer grade.

3. To remove the vehicle from storage in winter, proceed as follows:

a) Fill the engine lubrication system and the housings of the power transmission units with winter oil.

b) Prepare the engine for starting and start it as prescribed.

c) After the engine has been started, try it out at various speeds. Check whether gas leaks through the exhaust manifold flanges and the cylinder block head gasket. Look for oil, fuel and coolant leaks.

4. Check the instruments for performance.

5. Regardless of the season inspect the oil filters immediately after the engine has been warmed up and stopped.

6. Drive the vehicle to check the controls for proper operation and look for oil leaks from the housings of the power transmission.

Just before the beginning of the vehicle run, inspect the vehicle as prescribed in the present instructions.

Removing Electrical Equipment from Storage

When removing the vehicles from storage, perform the following operations:

1. Remove the wrapping paper and the preservative coating from the electrical equipment.

2. Wipe the surfaces of the electrical equipment dry. Install

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serviceable and fully charged storage batteries on the vehicle and connect the battery wiring.

3. Check the electrical equipment for serviceability and record the condition of the equipment in the vehicle Log Book.

USE OF CANVAS COVER

The canvas cover is intended for protecting the carrier only during the shipment by rail or stationary storage.

The installation of the canvas cover on the operating carrier is strictly forbidden as this will lead to overheating of the engine and carbon monoxide poisoning of the personnel being carried.

To install the cover on the vehicle, proceed as follows:

1. Install the support tubes into the frame seats and into the lugs provided on the drop gate and in the front part of the vehicle.
2. Install the canvas.
3. Attach rope *1* to the hooks welded to the vehicle hull (see Fig. 27).
4. Make the canvas cover taut by pulling rope *2* by the ring at the front of the vehicle and fasten the rope to the cleat (see Fig. 27).
5. Tighten cover rope *1* and fasten it to the front towing hooks.
6. To seal the covered vehicle pass soft wire, 1.5 *mm* in diameter, through the cover holes and the hooks welded to the hull.
7. When the carrier is in the travelling position, the cover should be removed. In this case stow the canvas at the port side in the compartment between the frames Nos. 3 and 4 and stow the support tubes in the compartment under the radiator shutters, where the tubes should be fastened with straps in the special brackets.
8. Fig. 27 illustrates the use of the cover.
9. Fig. 28 illustrates the securing of the vehicle on a flat car.

Requirements for Securing Carriers on Flat Cars

1. Shift the carrier gearbox into gear, apply brakes and secure the vehicle to the flat car with four 6 *mm* dia. wire braces (two braces at the rear and two braces at the front as shown in the diagram). Each brace should have at least four strands. On installing the braces, twist them to remove the slack. Use soft annealed wire free from cracks and burrs. Block the vehicle tracks with chocks nailed to the car floor with six 150 *mm* long nails. The nails should be driven home possibly square with the floor.

2. Place the vehicle symmetrically in relation to the car. The difference in width between the portions of the tracks projecting beyond the car sides must not be over 40 *mm*.

3. The car side boards should be dropped down and fastened to each other as well as to the board supports with 6 *mm* dia. wire.

4. On blocking the vehicle with chocks nail cross and lengthwise blocks to the car floor so that the blocks snugly fit the inner sides of the tracks and are

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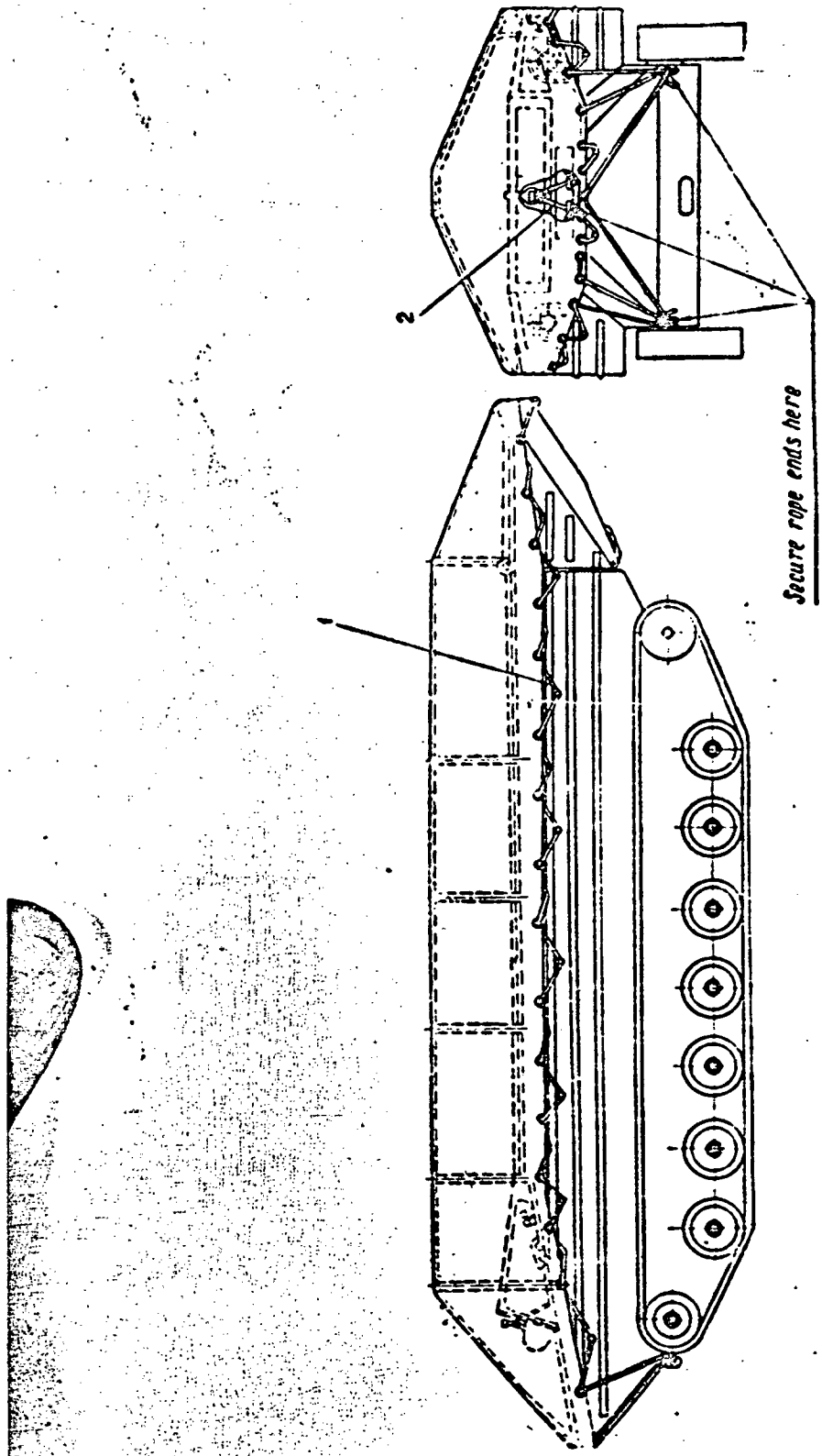

Fig. 27. Use of canvas cover

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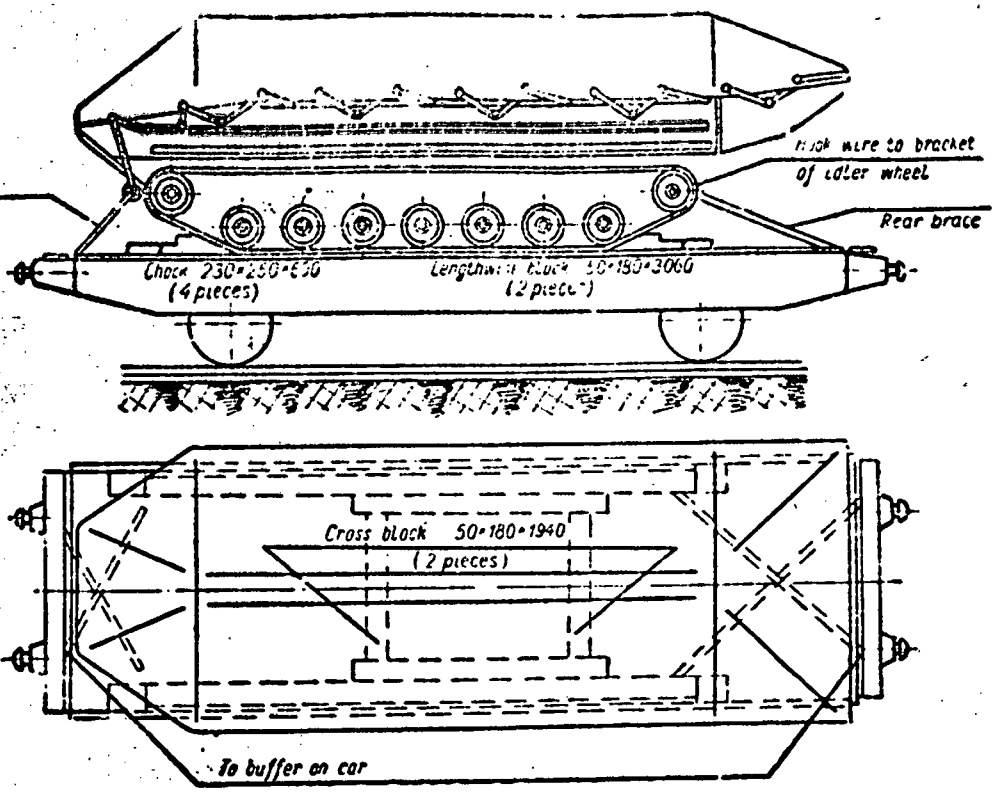
Hook wire to bracket of idler wheel
Front brace
Rear brace
Chock 230×250×600 (4 pieces)
Lengthwise block 50×180×3060 (2 pieces)
Cross block 50×180×1940 (2 pieces)
To buffer on car

Fig 28. Securing carrier on flat-car

symmetrical with the vehicle cross axis. Fasten each block with twelve 125 *mm* long nails. The cross blocks are allowed to be cut in situ to meet the requirements.

5. Seal the canvas cover. For the purpose pass 1.5±2 *mm* dia. annealed wire through the cover holes and the hooks welded to the vehicle hull. Tighten the wire, twist the wire ends at the vehicle front and install a seal.

Materials Required

1. Block, lengthwise 50×180×3060	2
2. Block, cross, 50×180×1940	2
3. Chock 230×250×600	4
4. Wire, 6 *mm* dia., *m*	80
5. Nails, 125 *mm* long, *kg*	2
6. Nails, 150 *mm* long, *kg*	1
7. Wire, 1.5 to 2 *mm* dia., *m*	30

ARRANGEMENT OF STRETCHERS

The vehicle can be fitted to carry eight stretchers (see Fig. 29). The side stretchers are installed with their feet in the seats provided for the purpose in the floor beams. The middle stretchers

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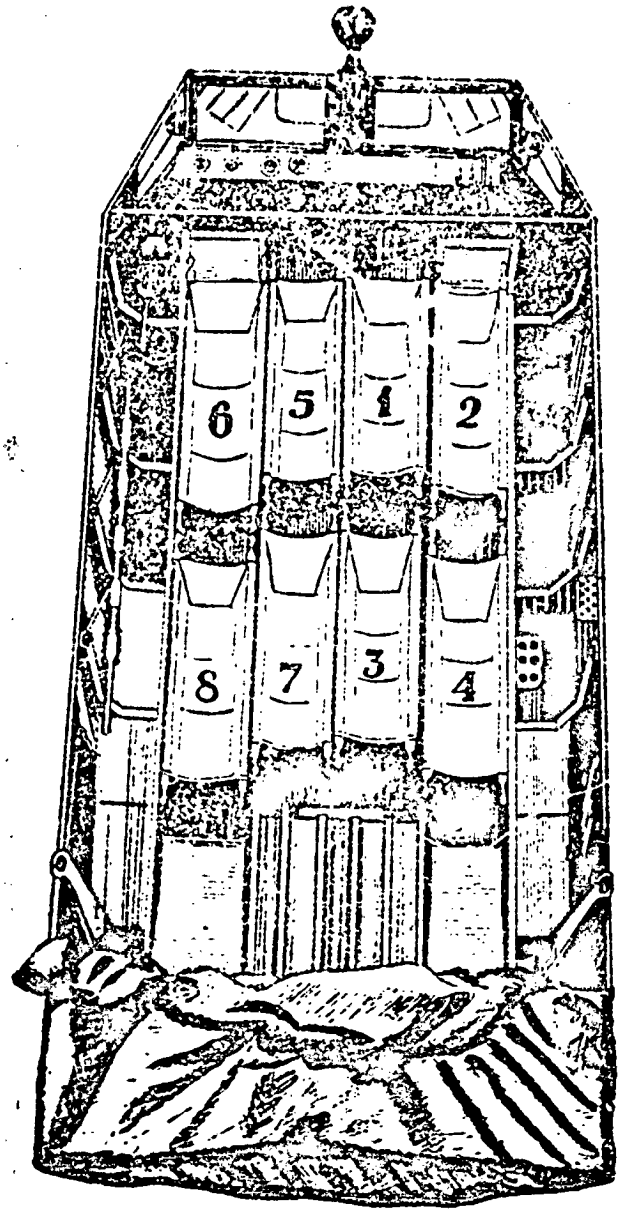

Fig. 29. Arrangement of stretchers

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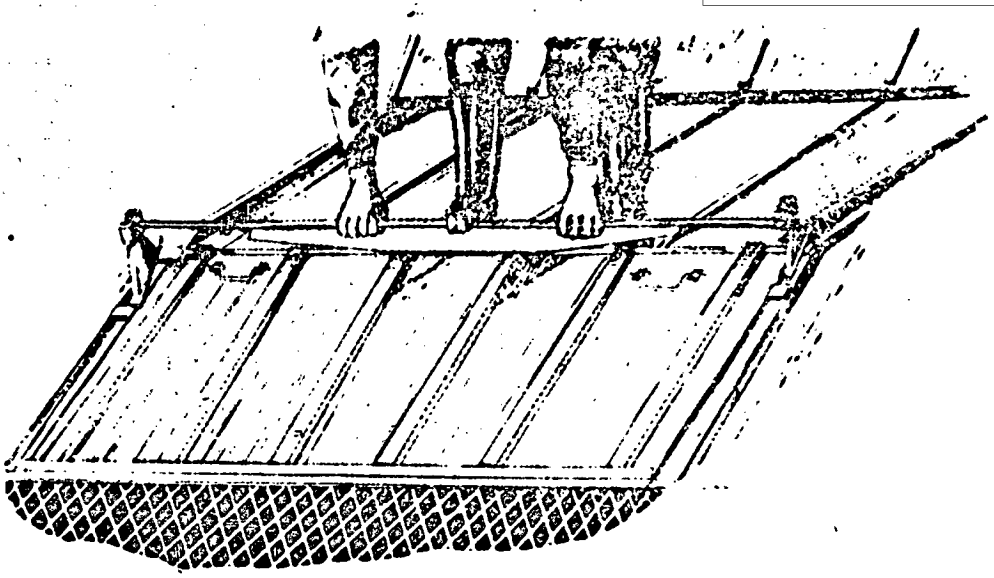

Fig. 30. Installing cross rods

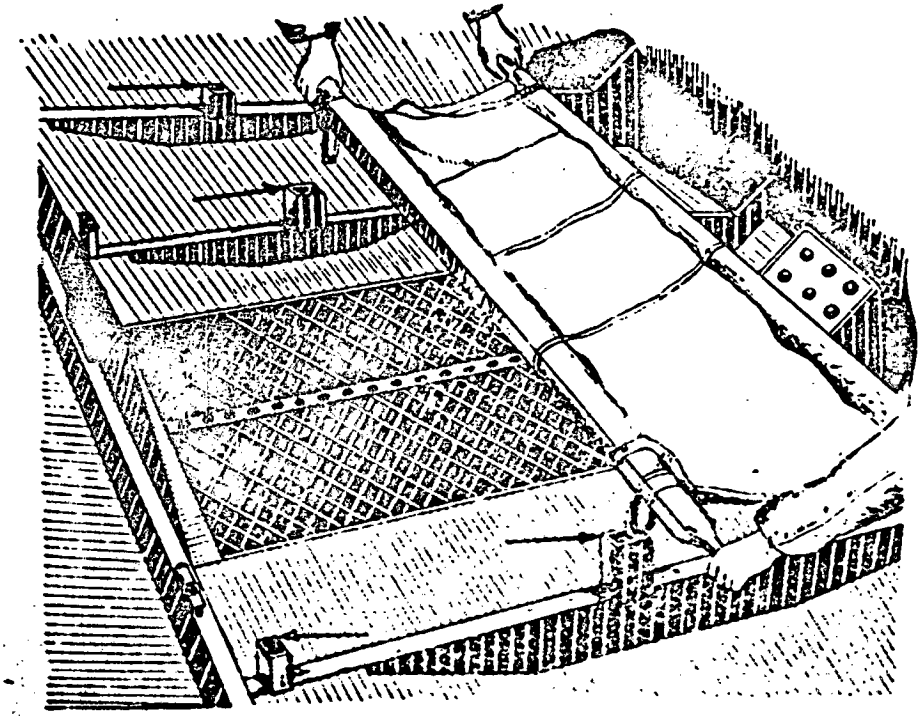

Fig. 31. Installing stretcher in cross rod seats

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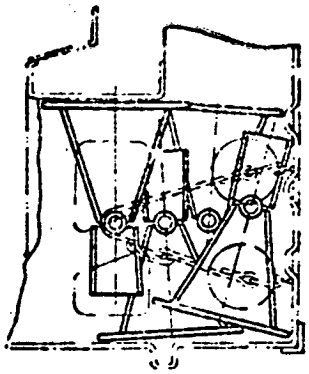

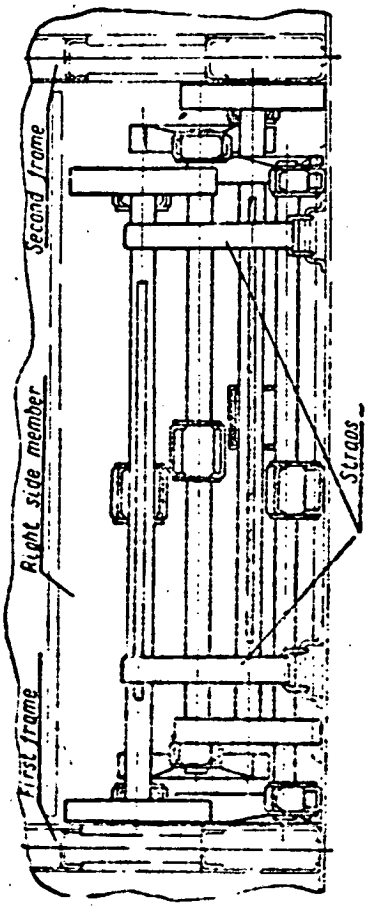

Fig. 32

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are installed on cross rods, each rod comprising a tube, carried on two supports, and three seats. The centre seat is of greater width to accommodate the two feet of the adjacent stretchers (Fig. 31). The cross rod supports are installed in the brackets welded to the vehicle floor (Fig. 30).

Transporting Sick Personnel

1. Remove the grating installed over the recess of compartment No. 1, unfasten the cross rod straps, take the cross rods out and install them so that their supports are set in the floor brackets (Fig. 30).

2. Install the stretchers with the sick in the seats of the cross rods and the floor beams in the sequence indicated by the numerals in Fig. 29.

3. On completion of the transportation, remove the cross rods, stow them in the recess of compartment No. 1 on the starboard side and fasten with the straps (Fig. 32).

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PURPOSE AND OPERATION OF FILLING UNIT

The M3A-3 small-size filling unit is designed for refilling the carrier with filtered diesel fuel and oil by delivering fuel or oil from barrels and KP-2 containers specified by the pertinent instructions.

If necessary, the unit may be used for washing the vehicles with water or partial desactivation.

Operating Unit

To refill the carrier by using the M3A-3 unit, proceed as follows:

1. Take the pump complete with the electric motor out of the box and install the extension suction pipe to suit the fuel container.
2. Unscrew the pump connection plugs. Immerse the suction pipe into the fuel container. Install the hose. To avoid priming the pump, use a container full of fuel. If the pump is primed, it will start operating regardless of the fuel level in the container.
3. Make sure that the unit switch is in the "off" position and connect the unit to the carrier mains.
4. Remove the protective cap from the nozzle spout and insert the nozzle into the vehicle tank filler neck.
5. Depress the nozzle lever and latch it in place.
6. Switch on the unit. On completion of filling, shut off the nozzle, install the protective cap and switch off the unit.
7. Drain fuel from the pump through the return hose. Drain the return hose and plug the hose and pump connections.
8. Wipe the unit with waste cloth and place the unit in the box.
9. To use the unit for filling with oil as well as for filling with diesel fuel having a temperature of below −20°C, perform items 1 through 8, having first replaced the fuel filter with an oil filter. The oil delivered by the unit should have a temperature of not below +25 to +30°C.
10. The use of the unit for transferring gasoline or other inflammable substances is strictly forbidden. Never run the unit empty. Never pump oil having a temperature of below +5°C.
11. To pump water for washing (desactivating) the vehicles, fit the unit with an oil filter. Do not use the pump without a filter.

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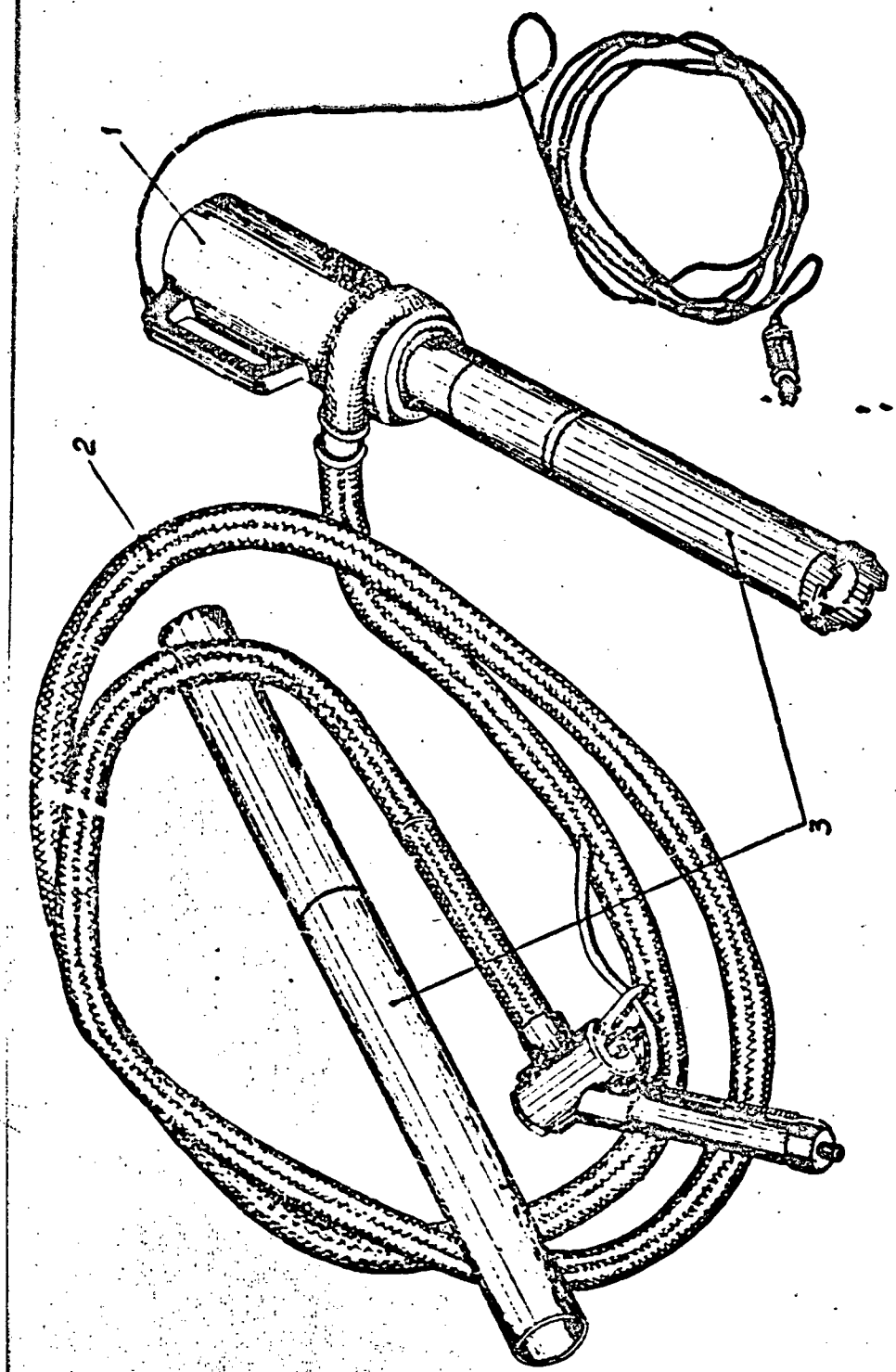

Fig. 33. Model M3A-3 small-size filling unit:
1—pump and motor unit; 2—hose with PK-25 nozzle; 3—extension suction pipes

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12. The unit is allowed to be run for a long time, provided the power for the pump motor is drawn from the vehicle 12 volt mains.

Care of Unit

To provide trouble-free operation of the unit, follow the instructions below:

1. Upon receipt of the unit deslush its pump. For the purpose immerse the pump for three minutes in aviation oil or MT-16-n oil heated to 60°C.
2. Before operating the unit, check that its suction line is clean.
3. After each operation of the unit check the mesh filter for cleanliness. If necessary, wash the filter in diesel fuel.
4. Every 10 to 15 filling operations lubricate the pump bearing with MT-16-n oil by pouring 2 *g* of oil through the hole provided on the pump body.
5. When preparing the vehicle for prolonged storage, slush the pump and the return valve with petrolatum. To do this, immerse the pump and valve in petrolatum heated to 60—70°C, then take them out and allow the surplus grease to run off.

Probable Troubles

Trouble	Cause	Remedy
No delivery	Air in pump	Prime pump by immersing suction pipe in full container or allow fluid in hose to flow into pump, by raising hose above pump and opening nozzle
Insufficient output	Clogged filter	Remove filter and wash it in diesel fuel
	Clogged pump	Disconnect suction pipe and correct fault. If necessary, disassemble and wash pump

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